

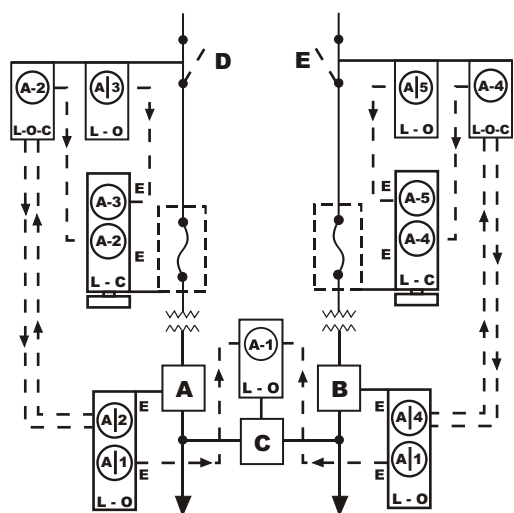
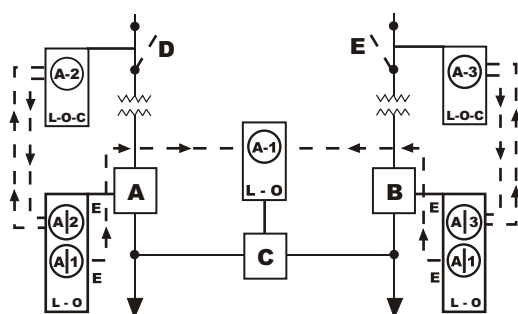
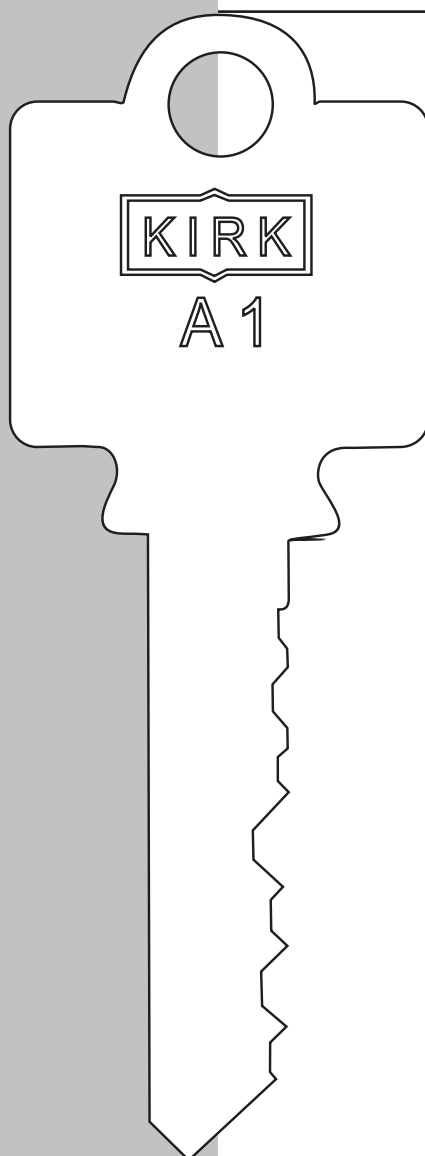
APPLICATION SCHEMES



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APPLICATION SCHEMES - Introduction

In order to lay out complicated interlock schemes, it is necessary to understand the simplest applications. On this page, the basic concepts of interlocking are outlined and discussed.

Interlocking a Single Unit in One Position

If it is desired to secure a device in the open position, an interlock is used as in Fig. 1. The possession of the key indicates

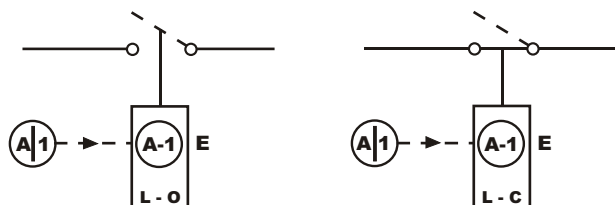


Fig. 1

that the device is in the open position and is locked by the extension of the interlock bolt. When the key is inserted in the lock and turned to withdraw the interlock bolt, the device is free to operate to the closed position and the key is held in the lock.

When a device is to be locked only in the closed position an interlock is used as shown in Fig. 2. The possession of the key indicates that the device is locked in the closed position, as the interlock bolt has been extended to remove the key. When the key is inserted in the lock and turned to withdraw the interlock bolt, the device is free to operate to the open position and the key is held in the lock.

Interlocking a Single Unit in Two Positions

Two methods are used in interlocking a device in both open and closed position. The first method requires only one interlock as shown in Fig. 3. The interlock bolt is extended in both the open and closed positions. This is accomplished with two recesses in the device that is being interlocked - each coinciding with the locking bolt in one position.

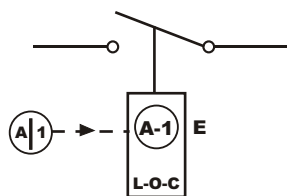


Fig. 3

The possession of the key indicates that the interlock bolt is extended and that the device is locked either in the open or closed position. Furthermore, the device cannot be operated until the key is inserted and turned in the lock to withdraw the locking bolt. The key cannot be removed from the lock in an intermediate position, but in the fully open or closed positions only. However, in this application, possession of the key gives no indication as to whether the device is locked closed or open.

Interlocking Two Units in Two Positions

The other method for locking in both the open and closed positions requires two interlocks as shown in Fig. 4. Possession of key A-1 indicates that the device is locked open; possession of key A-2 indicates that the device is locked closed. The device is shown normally open; therefore, key A-1 is free and the L-O interlock bolt is extended into its recess provided in the movable member while key A-2 is held and the L-C interlock bolt is withdrawn. To close the device, insert key A-1 in the L-O lock and turn to withdraw bolt of L-O interlock, which permits the device to be operated. Now the device can be moved to the closed position. Key A-2 can be turned to extend the bolt of the L-C interlock into its recess, which locks the device in the closed position.

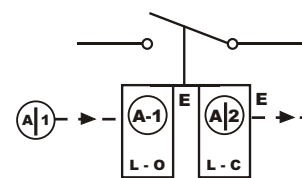


Fig. 4.

This releases Key A-2 from the L-C interlock. Meanwhile, key A-1 is held in the L-O interlock since its withdrawn locking bolt cannot be extended.

This method is used more often than the single two-position interlock shown in Fig. 3, due to its adaptability to sequence operations. Also, the possession of key A-1 or A-2 indicates that the device is locked open or locked closed, respectively.

Sequence Interlocking

With the fundamentals developed above, it is quite simple to extend the application to the interlocking of two or more devices in a desired sequence.

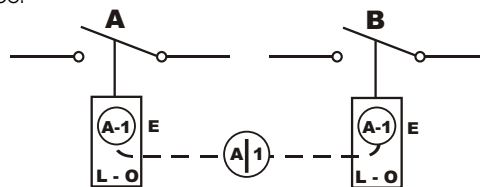
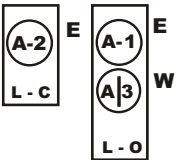


Fig. 5

Two devices are shown in Fig. 5. In operation they are not closed at the same time. With the interlocks arranged as shown, only one key is required in the interlocking system. Both devices are shown open; therefore, the key is free. To close any one device, the key is inserted and turned in that particular lock to withdraw the interlock bolt. The key is held in this lock until the device is again locked open. This simple interlocking sequence lends itself to a multitude of applications. The procedure is the same for two devices, neither of which is to be opened at the same time.

Legend\Symbols

	Device normally open.		Access door interlock (Detachable latch) Type D, DM or DY.		Interlock with auxiliary switch, 2 make - 2 break, Type SS
	Device normally closed.		Access door interlock Multi-cylinder (Detachable latch) Type D or DM.		Interlock with auxiliary switch, 3 make - 3 break, Type SSS
	Direction of key transfer.		Transfer interlock, Type T.		Interlock with auxiliary switch Type K
A-1, A-2, A-3	Key interchange number.		Transfer interlock, Type T. 3 cylinder		Key released after time delay.
	Interlock with key held. Device in position as shown.		Transfer interlock, Type T. 5 cylinder		Time-delay key release unit
	Interlock with key removed. Device in position as shown.		Padlock Type P		Initiating lock.
	Interlock used to lock device open. (with key removed)		Key Interchange number (showing key held).		Solenoid key release unit. Key released when solenoid is E, energized.
	Interlock used to lock device open. (with key held)		Interlock with auxiliary switch, 1 make - 1 break, Type S		Two key Solenoid key release unit. Key released when solenoid is E, energized.
	Interlock used to lock device closed. (with key removed)				Initiating key
	Interlock used to lock device closed. (with key held)				Key released when solenoid is energized.
	Interlock used to lock device open and closed.				
	Multi-lock interlock.				
	Interlock with an apartment lock. (Accepts one of two keys)				



Key Removable Positions

The "E" or "W" next to the interlock symbol indicates the position of the interlock bolt when the key is removable, "E" = Extended, "W" = Withdrawn.

For more information regarding key removable positions please reference the technical paper "How an Individual Key Interlock Operates" on our website (Click on the 'Application Info' button, then click on 'Technical Papers', then click on "How an Individual Key Interlock Operates"). Refer also to the Available Options on the interlock data sheets and to columns 8 and 9 on either Interlock Ordering Guide (Brass or 316 Stainless).

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Purpose of Interlocking

Scheme#	Function
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Switch and Breaker

Scheme #1	Prevents opening of switch when breaker is closed.
Scheme #2	Prevents operation of switch when breaker is closed. Permits re-closing the breaker for servicing when switch is locked open.
Scheme #3	Prevents operation of switch when breaker is closed. Circuit cannot be cleared until proper supervisory key is obtained.

Grounding Switch with Main Switch

Scheme #4	Prevents closing of grounding switch when main switch is closed, and vice versa.
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Isolating Switches and Breaker

Scheme #5	Prevents operation of disconnect when breaker is closed. Prevents opening fuse compartment door when disconnect is closed.
Scheme #6	Prevents operation of disconnect when any or all of a group of breakers are closed. Operates through transfer interlock, no sequence is required for breaker closing.
Scheme #7	Prevents operation of disconnect when any or all of a group of breakers are closed. Breakers operated in prearranged sequence.
Scheme #8	Prevents operation of disconnects when breaker is closed. Permits servicing of breaker when disconnects are locked open.
Scheme #9	Prevents operation of disconnects when breaker is closed, and prevents access to breaker compartment with disconnects closed.

Isolating Switches and Breaker or Regulator with By-Pass Switch

Scheme #10	Prevents operation of breaker disconnects and by-pass disconnect under load. Provides for closing of by-pass disconnect before breaker circuit is opened, or permits circuit breaker to be opened with by-pass disconnect remaining open.
Scheme #10A	Prevents operation of voltage regulator disconnects and by-pass disconnect under load. Permits by-pass disconnect to operate only when regulator is in neutral position. Permits isolating regulator for servicing.

Prevent Paralleling of Lines

Scheme #11	Prevents paralleling of two lines - single load, fed from either source.
Scheme #12	Prevents paralleling of two lines - single load, fed from either source - breaker on load side.
Scheme #13	Prevents paralleling of two lines - two loads, fed from either source (one tie breaker)
Scheme #14	Prevents paralleling of two lines - two loads, fed from either source (one tie breaker). Prevents operation of switch when breaker is closed (on either source).
Scheme #15	Prevents paralleling of two lines - two loads fed from either source (one tie breaker). Prevents operation (open or closed) of disconnect when breaker is closed (on either source). Prevents access to fuses when disconnects and breakers are closed.
Scheme #16	Prevents paralleling of three lines - three loads, fed from any source (two tie breakers).
Scheme #17	Prevents paralleling of four lines - four loads fed from any source (three tie breakers)
Scheme #17A	Prevents paralleling of four lines - four loads fed from any source (three tie breakers). Also prevents opening of rear access doors when breakers are energized.
Scheme #18	Prevents paralleling of three lines - three loads fed from any source (three tie breakers).
Scheme #19	Prevents paralleling of four lines - four loads fed from any source (four tie breakers).
Scheme #20	Prevents paralleling of three power sources through a common tie bus not normally in service. Permits feeding any load bus from a second power source through the tie bus. Permits one power source to supply all three load buses through the tie bus.
Scheme #21	Prevents paralleling three power sources through a common tie bus not normally in service. Permits feeding any load bus from a second power source through the tie bus only when authorized by a supervisor. Permits one power source to supply all three load buses through the tie bus only when authorized by a supervisor.
Scheme #22	Prevents paralleling two incoming primary sources through primary tie bus disconnect. Prevents operation (open or closed) of the disconnects under load. Permits one power source to supply both loads through tie bus.
Scheme #23	Prevents paralleling of two incoming primary sources through the primary tie bus disconnect or secondary tie bus breaker. Prevents operation (open or closed) of disconnects under load. Permits one power source to supply both loads through either the primary or secondary tie bus.
Scheme #24	Prevents paralleling of two incoming primary sources. Prevents operation (open or closed) of disconnects under load. Permits the isolating of breakers for servicing. Permits one power source to supply both loads through tie bus.

Interrupter Switch

Scheme #25	Prevents opening fuse compartment door when the interrupter switch is closed. Prevents closing interrupter switch until fuse compartment door is locked closed.
Scheme #26	Prevents operation (open or closed) of interrupter switch when breaker is closed. Permits the breaker to be serviced and operated while the interrupter switch is locked open.

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Purpose of Interlocking

Scheme#	Function
---------	----------

Interrupter Switch

- | | |
|------------|---|
| Scheme #27 | Prevents operation (open or closed) of interrupter switch when breaker is closed. Prevents opening fuse compartment door when interrupter switch is closed. Prevents closing interrupter switch until fuse compartment door is locked closed. Permits the breaker to be serviced and operated while the interrupter switch is locked open. |
| Scheme #28 | Prevents dropping load when shifting from one source to the other. Prevents opening both interrupter switches at the same time. Permits both interrupter switches to be closed at the same time. |
| Scheme #29 | Prevents paralleling two lines - requires dropping load when shifting from one source to the other. Prevents closing both interrupter switches at the same time. Permits both interrupter switches to be opened at the same time. |
| Scheme #30 | Prevents paralleling two lines - requires dropping load when shifting from one source to the other. Prevents closing both interrupter switches at the same time. Permits both interrupter switches to be open at the same time. Prevents operation (open or closed) of either interrupter switch when breaker is closed. Permits the breaker to be serviced and operated while both interrupter switches are locked open. |
| Scheme #31 | Prevents operation (closed, open or closed) of a three position interrupter switch when the breaker is closed. Permits the breaker to be serviced and operated while the interrupter switch is locked open. |
| Scheme #32 | Prevents operation (closed, open or closed) of a three position interrupter switch when the breaker is closed. Prevents opening fuse compartment door when the interrupter switch is closed. Prevents closing interrupter switch until fuse compartment door is locked closed. Permits the breaker to be serviced and operated while the interrupter switch is locked open. |

Motor or Machinery Guard

- | | |
|------------|---|
| Scheme #33 | Prevents opening of guard when motor circuit is closed. Guard may be a door or fence gate that prevents access to moving parts, belts, cutters, or any dangerous equipment. |
|------------|---|

Motor or Machinery Guard with Time Delay

- | | |
|------------|--|
| Scheme #34 | Prevents opening of guard (or door) for a predetermined time after removal of power (from motor, centrifuge, condensers, etc.) |
|------------|--|

Breakers and Generators

- | | |
|-------------|--|
| Scheme #35 | Prevents paralleling of two lines - two loads, fed from either source (one tie breaker). Allows switching loads to a generator. |
| Scheme #35A | Prevents closing generator breaker when main breaker is closed. |
| Scheme #36 | Prevents paralleling of two lines - two loads, fed from either source (one tie breaker). Allows switching loads to two generators. |

Capacitor Bank Access

- | | |
|------------|---|
| Scheme #37 | Prevents access to capacitor bank enclosure until capacitors have been grounded and discharged. |
| Scheme #38 | Prevents access to capacitor bank enclosure until capacitors have been grounded and discharged - utilizing a Time Delay Key Release Unit (TDKRU). |

Uninterrupted Power Sources

- | | |
|------------|--|
| Scheme #39 | Prevents improper maintenance bypass of UPS equipment. |
| Scheme #40 | Prevents improper maintenance bypass of UPS equipment. |

Precipitator Access

- | | |
|-------------|--|
| Scheme #41 | Prevents access to an electrostatic precipitator, scrubber, or baghouse until all power supplies have been de-energized and properly grounded. |
| Scheme #42 | To allow operation of dual output transformer rectifiers with one field removed from service and to prevent opening any access doors of an electrostatic precipitator until all power supplies are de-energized and properly grounded. |
| Scheme #42A | To allow operation of dual output transformer rectifiers with one field removed from service and to prevent opening any access doors of an electrostatic precipitator until all power supplies are de-energized and properly grounded. |
| Scheme #42B | To allow operation of dual output transformer rectifiers with one field removed from service and to prevent opening any access doors of an electrostatic precipitator until all power supplies are de-energized and properly grounded. |

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Purpose of Interlocking

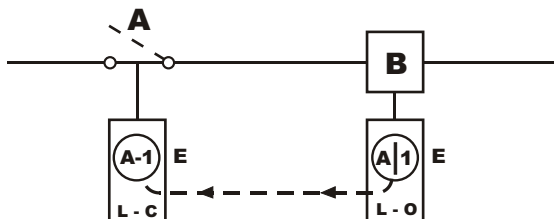
Scheme#	Function
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Rectifier Access

Scheme #43	Prevents opening any rectifier enclosure door while the rectifier is operating.
Scheme #43A	Prevents opening any rectifier enclosure door while the rectifier is operating.
Scheme #44	Prevents opening any rectifier enclosure door while the rectifier is operating.
Scheme #45	Prevents opening any rectifier enclosure door while the rectifier is operating and prevents opening the negative disconnect switch under load.
Scheme #45A	Prevents opening any rectifier enclosure door while the rectifier is operating and prevents opening the negative disconnect switch under load.

Scheme 1

To prevent opening of switch A when breaker B is closed.



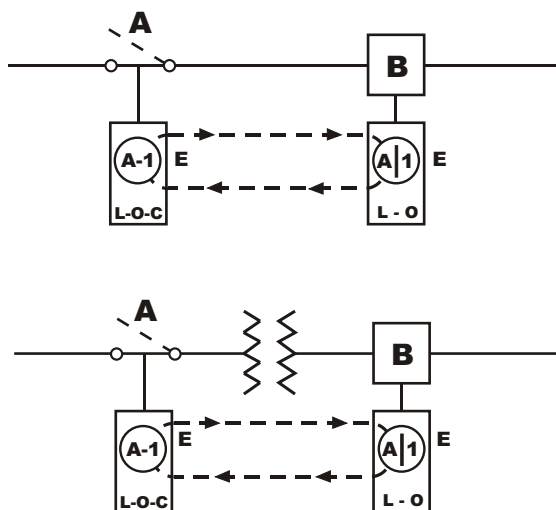
Switch A and breaker B are in closed position. Key A-1 is held in breaker B interlock.

1. Open breaker.
2. Turn key A-1 in L-O interlock on breaker B to lock open. Key A-1 is now free.
3. Insert key A-1 in L-C interlock on switch A and turn to unlock.
4. Open switch A. Key A-1 is now held.

Reverse sequence to restore service.

Scheme 2

To prevent operation of switch A when breaker B is closed. Permits re-closing of breaker for servicing when switch is locked open.



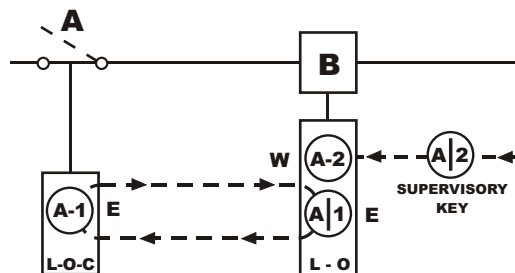
Switch A and breaker B are in closed position. Key A-1 is held in breaker B interlock.

1. Open breaker.
2. Turn key A-1 in L-O interlock on breaker B to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O-C interlock on switch A and turn to unlock.
4. Open switch A. Key A-1 is now held.
5. Turn key A-1 in L-O-C interlock on switch A to lock open. Key A-1 is now free.
6. Return Key A-1 to breaker interlock and unlock for operation during servicing period.

Reverse sequence to restore service.

Scheme 3

To prevent operation of switch A when breaker B is closed. Circuit cannot be cleared until proper supervisory key is obtained.



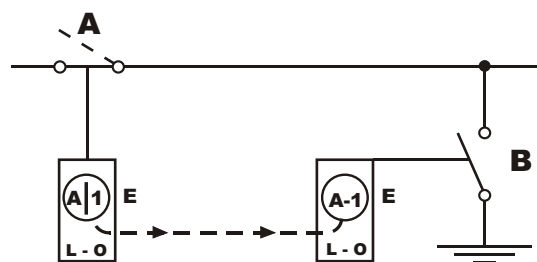
Breaker B and switch A shown closed. Key A-1 held in breaker interlock. Key A-2 retained by supervisor.

1. Obtain key A-2 from supervisor.
2. Open breaker.
3. Insert key A-2 in L-O interlock on breaker B and turn key A-1 to lock open. Key A-2 is now held and key A-1 is free.
4. Insert key A-1 in L-O-C interlock on switch A and turn to unlock.
5. Open switch A.
6. Turn key A-1 in L-O-C interlock on switch A to lock open. Key A-1 is now free.
7. Return key A-1 to breaker interlock and unlock for operation during servicing period.

Reverse sequence to restore service.

Scheme 4

To prevent closing of grounding switch B when main switch A is closed, and vice versa.



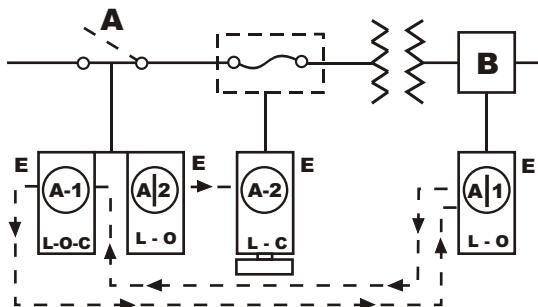
Main switch A shown closed and grounding switch B shown open. Key A-1 is held in main switch interlock.

1. Open main switch A.
2. Turn key A-1 in L-O interlock on main switch A to lock open. Key A-1 is now free.
3. Insert Key A-1 in L-O interlock on grounding switch B and turn to unlock. Key A-1 is now held.
4. Close grounding switch B.

Reverse sequence to restore service.

Scheme 5

To prevent operation of disconnect switch A when breaker B is closed.
To prevent opening fuse compartment door when the disconnect switch A is closed.



Breaker, fuse compartment door and disconnect switch are shown in closed positions. Key A-1 is held in breaker interlock and key A-2 is held in disconnect interlock.

To service breaker:

1. Open breaker.
2. Turn key A-1 in L-O interlock on breaker to lock breaker open. Key A-1 is now free.
3. Insert key A-1 in L-O-C interlock on disconnecting switch and turn to unlock. Key A-1 is now held.
4. Open disconnect.
5. Turn key A-1 in L-O-C interlock on disconnect switch to lock open. Key A-1 is now free.
6. Return key A-1 to breaker interlock and unlock for operation of breaker during servicing.

Reverse sequence to restore service.

To open fuse compartment door:

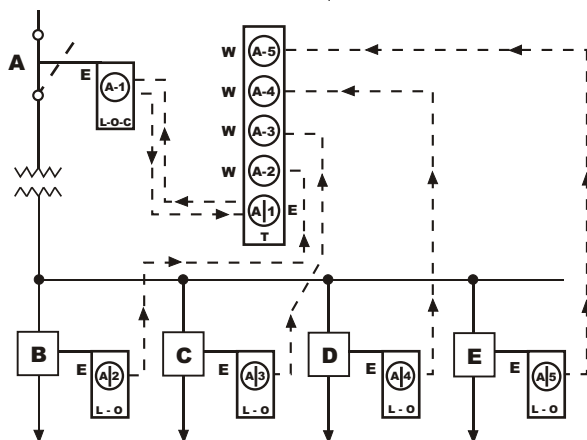
1. Proceed from normal position with operations as in 1 through 4 above.
2. Turn key A-2 in L-O interlock on disconnect switch to lock open. Key A-2 is now free.
3. Insert key A-2 in L-C interlock on fuse compartment door and turn to unlock. Key A-2 is now held.
4. Open fuse compartment door.

Reverse sequence to restore service.

Scheme 6

To prevent operation of disconnect switch A when breakers B, C, D and E are closed. Breakers may be opened in any sequence.

NOTE: Electrical circuit is equivalent of Scheme 7.



Disconnect A and breakers B, C, D and E are shown in closed position. Key A-1 is held in transfer interlock. Keys A-2, A-3, A-4 and A-5 are held in interlocks on breaker B, C, D and E.

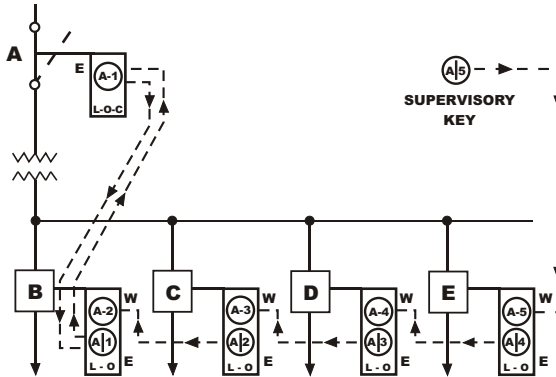
1. Open breakers B, C, D and E.
2. Turn key in L-O interlock on each breaker B, C, D and E to lock breakers open. Keys A-2, A-3, A-4 and A-5 are now free.
3. Insert keys A-2, A-3, A-4 and A-5 in transfer interlock.
4. Turn key A-1 in transfer interlock. Key A-1 is now free. Keys A-2, A-3, A-4 and A-5 are now held.
5. Insert key A-1 in L-O-C interlock on disconnect A and turn to unlock. Key A-1 is now held.
6. Open disconnect A.
7. Turn key A-1 in L-O-C interlock on disconnect A to lock open. Key A-1 is now free.
8. Insert key A-1 in transfer interlock and turn. Key A-1 is now held. Keys A-2, A-3, A-4 and A-5 are now free.
9. Return keys A-2, A-3, A-4 and A-5, as desired, to breaker interlocks and unlock for operation during servicing.

Reverse sequence to restore service.

Scheme 7

To prevent operation of disconnect switch A when breakers B, C, D and E are closed. Breakers must be opened in pre-arranged sequence.

NOTE: Electrical circuit is equivalent of Scheme 6.



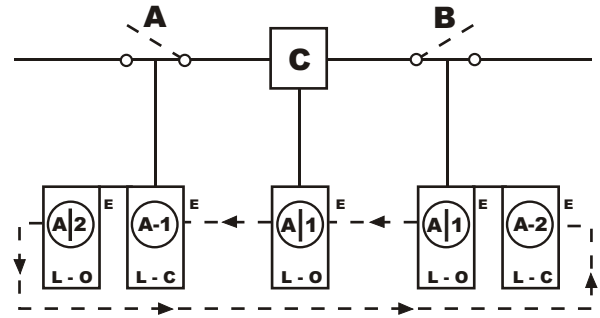
Disconnect A and breakers B, C, D and E are shown in closed position. Key A-1 is held in breaker B interlock, key A-2 is held in breaker C interlock, key A-3 is held in breaker D interlock and key A-4 is held in breaker E interlock. Key A-5 is held free in breaker E interlock or is retained by supervisor.

1. Obtain key A-5 from supervisor.
2. Open breaker E.
3. Insert key A-5 in L-O interlock on breaker E and turn key A-4 to lock open. Key A-5 is now held. Key A-4 is now free.
4. Open breaker D.
5. Insert key A-4 in L-O interlock on breaker D and turn key A-3 to lock open. Key A-4 is now held. Key A-3 is now free.
6. Open breaker C.
7. Insert key A-3 in L-O interlock on breaker C and turn key A-2 to lock open. Key A-3 is now held. Key A-2 is now free.
8. Open breaker B.
9. Insert key A-2 in L-O interlock on breaker B and turn key A-1 to lock open. Key A-2 is now held. Key A-1 is now free.
10. Insert key A-1 in L-O-C interlock on disconnect A and turn to unlock. Key A-1 is now held.
11. Open disconnect A.
12. Turn key A-1 in L-O-C interlock on disconnect A to lock open. Key A-1 is now free.
13. Insert key A-1 in L-O interlock on breaker B and turn to unlock. Key A-1 is now held and key A-2 is now free.
14. Breaker B may now be operated for servicing.
15. Insert key A-2 in L-O interlock on breaker C and turn to unlock. Key A-2 is now held and Key A-3 is now free.
16. Breaker C may now be operated for servicing.
17. Insert key A-3 in L-O interlock on breaker D and turn to unlock. Key A-3 is now held and key A-4 is now free.
18. Breaker D may now be operated for servicing.
19. Insert key A-4 in L-O interlock on breaker E and turn to unlock. Key A-4 is now held and supervisor Key A-5 is now free.
20. Breaker E may now be operated for servicing.

Reverse sequence to restore service.

Scheme 8

To prevent operation of disconnects A and B when breaker C is closed. To permit servicing of breaker when disconnects are locked open.



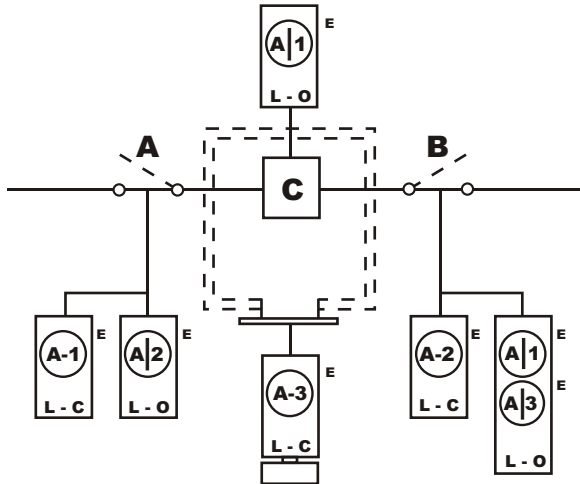
Breaker C and disconnects A and B are shown closed. One key A-1 is held in breaker L-O interlock and the other key A-1 is held in L-O interlock on disconnect B. Key A-2 is held in L-O interlock on disconnect A.

1. Open breaker.
2. Turn key A-1 in L-O interlock on breaker to lock open. Key A-1 is now free.
3. Insert key A-1 in L-C interlock on disconnect A and turn to unlock. Key A-1 is now held.
4. Open disconnect A.
5. Turn key A-2 in L-O interlock on disconnect A to lock open. Key A-2 is now free.
6. Insert key A-2 in L-C interlock on disconnect B and turn to unlock. Key A-2 is now held.
7. Open disconnect B.
8. Turn key A-1 in L-O interlock on disconnect B to lock open. Key A-1 is now free.
9. Insert key A-1 in breaker L-O interlock and turn to unlock for operation during servicing.

Reverse sequence to restore service.

Scheme 9

To prevent operation of disconnects A and B with breaker C closed. To prevent access to breaker compartment with disconnects closed.



Disconnects A and B, breaker C, and door are normally closed. Keys A-1 are held in L-O interlock on breaker C and L-O interlock on disconnect B. Key A-2 is held in the L-O interlock on disconnect A. Key A-3 is held in L-O interlock on disconnect B.

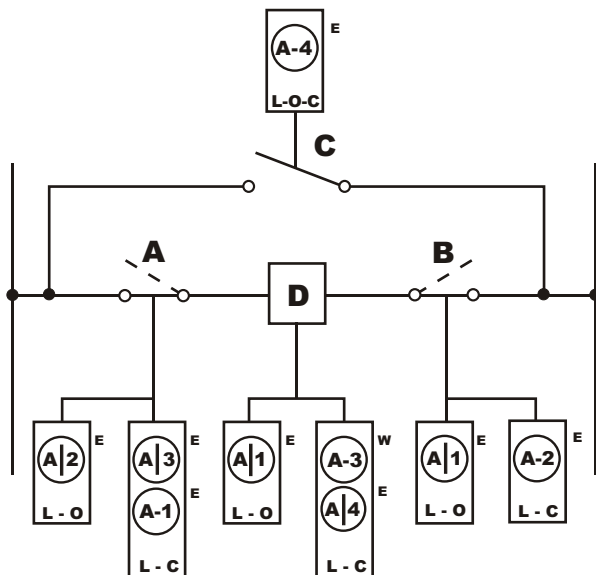
1. Open breaker.
2. Turn key A-1 in L-O interlock on breaker to lock open. Key A-1 is now free.
3. Insert key A-1 in L-C interlock on disconnect A and turn to unlock. Key A-1 is now held.
4. Open disconnect A.
5. Turn key A-2 in L-O interlock on disconnect A to lock open. Key A-2 is now free.
6. Insert key A-2 in L-C interlock on disconnect B and turn to unlock. Key A-2 is now held.
7. Open disconnect B.
8. Turn keys A-1 and A-3 in L-O interlock on disconnect B to lock open. Keys A-1 and A-3 are now free.
9. Insert key A-1 in breaker L-O interlock and turn to unlock for operation during servicing.
10. Insert key A-3 in L-C interlock (type D) on compartment door and turn to unlock. Key A-3 is now held.
11. Open compartment door to service breaker.

Reverse sequence to restore service.

Scheme 10

To prevent operation of disconnects A and B and by-pass disconnect C under load. Provides for closing of by-pass disconnect C before breaker circuit is opened, or permits breaker circuit to be opened with by-pass disconnect C remaining open.

Disconnects A and B and breaker D normally closed. By-pass disconnect C normally open. Keys A-1, A-2, and A-4 normally held in locks as indicated. Key A-3 normally free.



To transfer load from breaker and disconnects to by-pass switch:

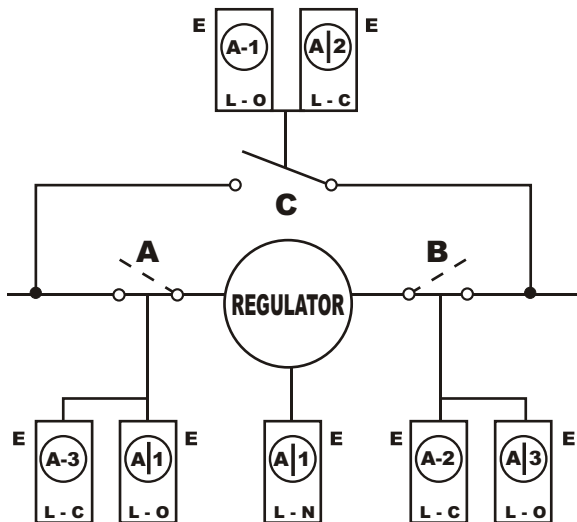
1. Obtain key A-3 which is free and insures that both disconnects A and B are locked closed.
2. Insert key A-3 in L-C interlock on breaker D and turn to lock closed. Key A-3 is held and key A-4 is now free.
3. Insert key A-4 in L-O-C interlock on by-pass disconnect C and turn to unlock. Key A-4 is now held.
4. Close by-pass disconnect C.
5. Turn key A-4 in L-O-C interlock on by-pass disconnect C to lock closed. Key A-4 is now free.
6. Insert key A-4 in L-C interlock on breaker D and turn to unlock. Key A-4 is held and key A-3 is now free.
7. Open breaker D.
8. Turn key A-1 in L-O interlock on breaker D to lock open. Key A-1 is now free.
9. Insert keys A-1 and A-3 in L-C interlock on disconnect A and turn to unlock. Keys A-1 and A-3 are now held.
10. Open disconnect A.
11. Turn key A-2 in L-O interlock on disconnect A to lock open. Key A-2 is now free.
12. Insert key A-2 in L-C interlock on disconnect B and turn to unlock. Key A-2 is now held.
13. Open disconnect B.
14. Turn key A-1 in L-O interlock on disconnect B to lock open. Key A-1 is now free.
15. Insert key A-1 in L-O interlock on breaker D and turn to unlock to permit operation during servicing.

To open disconnects A and B and breaker D, leaving by-pass disconnect C open:

1. Proceed from normal position with operations as in 7 to 15 above.

Scheme 10A

To prevent operation of disconnect A and B and by-pass disconnect C under load. Permits by-pass disconnect C to operate only when regulator is in neutral position. Permits isolating regulator for servicing.



Disconnects A and B are normally closed. Regulator is normally in operation. By-pass disconnect C is normally open.

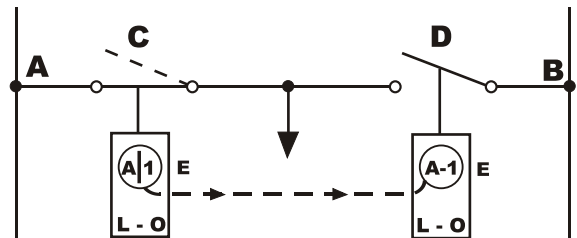
One key A-1 is held in regulator L-N (locked neutral) interlock and the second key A-1 is held in L-O interlock on disconnect A. Key A-2 is held in L-C interlock on disconnect C. Key A-3 is held in L-O interlock on disconnect B.

1. Operate regulator to neutral position.
2. Turn key A-1 in L-N interlock on regulator to lock in neutral position. Key A-1 is now free.
3. Insert key A-1 in L-O interlock on by-pass disconnect C and turn to unlock. Key A-1 is now held.
4. Close by-pass disconnect C.
5. Turn key A-2 in L-C interlock on by-pass disconnect C to lock closed. Key A-2 is now free.
6. Insert key A-2 in L-C interlock on disconnect B and turn to unlock. Key A-2 is now held.
7. Open disconnect B.
8. Turn key A-3 in L-O interlock on disconnect B to lock open. Key A-3 is now free.
9. Insert key A-3 in L-C interlock on disconnect A and turn to unlock. Key A-3 is now held.
10. Open disconnect A.
11. Turn key A-1 in L-O interlock on disconnect A to lock open. Key A-1 is now free.
12. Insert key A-1 in regulator L-N interlock and turn to unlock. This permits regulator to be operated during inspection and servicing.

Reverse sequence to restore service.

Scheme 11

To prevent paralleling of lines A and B. Single load, fed from either source.



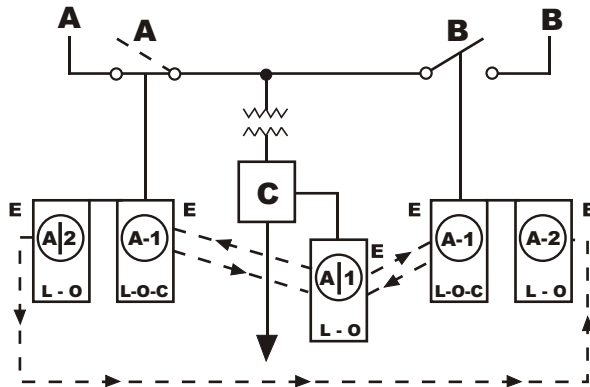
Disconnect C shown closed and disconnect D shown open. Key A-1 is held in disconnect C interlock.

1. Open switch C.
2. Turn key A-1 in L-O interlock on switch C to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O interlock on switch D and turn to unlock. Key A-1 is now held.
4. Close switch D.

Reverse sequence to restore service through switch C.

Scheme 12

To prevent paralleling of lines A and B. Single load, fed from either source. To prevent operation of disconnect switches A and B when breaker C is closed.



Breaker C and disconnect A are shown in closed position. Disconnect B is shown in open position. Key A-1 is held in breaker C interlock. Key A-2 is held in L-O interlock on disconnect A.

To service breaker:

1. Open breaker C.
2. Turn key A-1 in L-O interlock on breaker to lock open. Key A-1 is now free.

3. Insert key A-1 in L-O-C interlock on disconnect A and turn to unlock. Key A-1 is now held.
4. Open disconnect A.
5. Turn key A-1 in L-O-C interlock on disconnect A to lock open. Key A-1 is now free.
6. Return key A-1 to breaker interlock and unlock for operation of breaker during servicing.

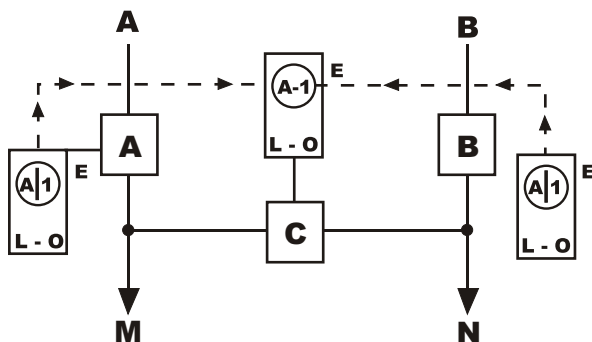
To transfer load from line A to line B:

1. Open breaker C.
2. Turn key A-1 in L-O interlock on breaker to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O-C interlock on disconnect A and turn to unlock. Key A-1 is now held.
4. Open disconnect A.
5. Turn key A-1 in L-O-C interlock and key A-2 in L-O interlock on disconnect A to lock open. Keys A-1 and A-2 are now free.
6. Insert key A-1 in L-O-C interlock on disconnect B and turn to unlock. Key A-1 is now held.
7. Insert key A-2 in L-O interlock on disconnect B and turn to unlock. Key A-2 is now held.
8. Close disconnect B.
9. Turn key A-1 in L-O-C interlock on disconnect B to lock closed. Key A-1 is now free.
10. Insert key A-1 in breaker interlock and turn to unlock. Key A-1 is now held.
11. Close breaker.

Reverse sequence to restore service through line A.

Scheme 13

To prevent paralleling of lines A and B. Two loads, fed from either source.



Breaker A is closed to supply load M. Breaker B is closed to supply load N. Tie-breaker C is open. Keys A-1 are held in interlocks on both breakers A and B. Tie-breaker C cannot be closed unless either A or B is locked open.

To transfer load N to breaker A:

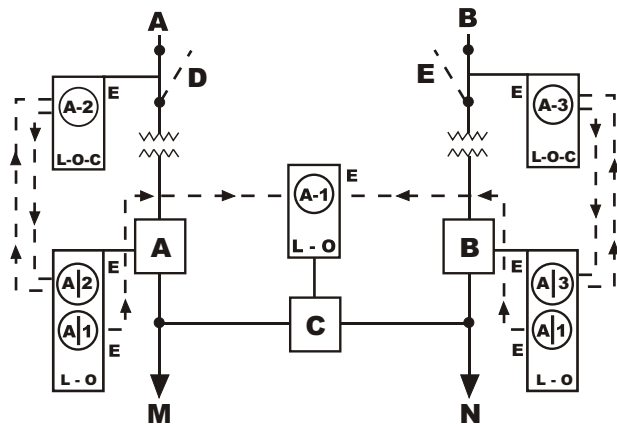
1. Open breaker B
2. Turn key A-1 in L-O interlock on breaker B to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O interlock on tie-breaker C and turn to unlock. Key A-1 is now held.
4. Close tie-breaker C.

Reverse sequence to restore service.

Load M can be supplied through breaker B in a similar manner.

Scheme 14

To prevent paralleling of lines A and B. Two loads, fed from either source (one tie-breaker). To prevent operation of disconnect switch D when breaker A is closed. To prevent operation of disconnect switch E when breaker B is closed.



Disconnect switches D and E and breakers A and B are closed. Breaker A closed to supply load M. Breaker B closed to supply load N. Tie-breaker C is open. Keys A-1 and A-2 are held in interlock on breaker A. Keys A-1 and A-3 are held in interlock on breaker B. Tie-breaker C cannot be closed until either breaker A or B is locked open.

To transfer load N to breaker A:

1. Open breaker B.
2. Turn key A-1 in L-O interlock on breaker B to lock open. Keys A-1 and A-3 are now free.
3. Insert key A-1 in L-O interlock on tie-breaker C and turn to unlock. Key A-1 is now held.
4. Close tie-breaker C.

Reverse sequence to restore service through breaker B. Load M can be supplied through breaker B in a similar manner.

To service breaker B:

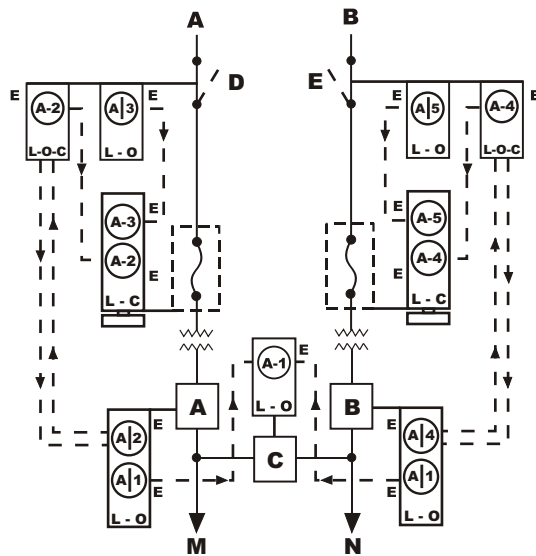
1. Open breaker B.
2. Turn key A-1 in L-O interlock on breaker B to lock open. Keys A-1 and A-3 are now free.
3. Insert key A-3 in L-O-C interlock on disconnect E and turn to unlock. Key A-3 is now held.
4. Open disconnect E.
5. Turn key A-3 in L-O-C interlock on disconnect E to lock open. Key A-3 is now free.
6. Return key A-3 to L-O interlock on breaker B and unlock for operation of breaker during servicing.

Reverse sequence to restore service. Breaker A can be serviced in a similar manner.

Scheme 15

To prevent paralleling of lines A and B. Two loads, fed from either source (one tie-breaker). To prevent operation of disconnect D when breaker A is closed. To prevent operation of disconnect switch E when breaker B is closed. To prevent opening fuse compartment door when the associated disconnects D or E and breakers A and B are closed.

Scheme 15 - (Continued)



Disconnect switch D and breaker A are closed to supply load M. Disconnect switch E and breaker B are closed to supply load N. Tie-breaker C is open. Keys A-1 and A-2 are held in interlock on breaker A. Key A-3 is held in L-O interlock on disconnect D. Keys A-1 and A-4 are held in interlock on breaker B. Key A-5 is held in L-O interlock on disconnect E. Tie-breaker C cannot be closed until either breaker A or B is locked open.

To transfer load N to breaker A, proceed as follows:

1. Open breaker B.
2. Turn key A-1 in L-O interlock on breaker B to lock open. Keys A-1 and A-4 are now free.
3. Insert key A-1 in L-O interlock on tie-breaker C and turn to unlock. Key A-1 is now held.
4. Close tie-breaker C.

Reverse sequence to restore service through breaker B. Load M can be supplied through breaker B in a similar manner.

To service breaker B, proceed as follows:

1. Open breaker B.
2. Turn key A-1 in L-O interlock on breaker B to lock open. Keys A-1 and A-4 are now free.
3. Insert key A-4 in L-O-C interlock on disconnect E and turn to unlock. Key A-4 is now held.
4. Open disconnect E.
5. Turn key A-4 in L-O-C interlock on disconnect E to lock open. Key A-4 is now free.
6. Return key A-4 to L-O interlock on breaker B and unlock for operation of breaker during servicing.

Reverse sequence to restore service. Breaker A can be serviced in a similar manner.

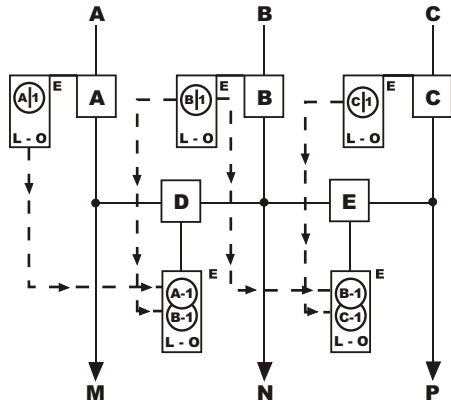
To enter fuse compartment on line B, proceed as follows:

1. Open breaker B.
2. Turn key A-1 in L-O interlock on breaker B to lock open. Keys A-1 and A-4 are now free.
3. Insert key A-4 in L-O-C interlock on disconnect E and turn to unlock. Key A-4 is now held.
4. Open disconnect E.
5. Turn key A-4 in L-O-C interlock on disconnect E to lock open. Key A-4 is now free.
6. Turn key A-5 in L-O interlock on disconnect E to lock open. Key A-5 is now free.
7. Insert keys A-4 and A-5 in L-C interlock on fuse compartment door and turn to unlock. Keys A-4 and A-5 are now held.
8. Open fuse compartment door.

Reverse sequence to restore service. Fuse compartment on line A can be entered in a similar manner.

Scheme 16

To prevent paralleling of lines A, B, and C. Three loads, fed from any source (two tie-breakers).



Breaker A is closed to supply load M. Breaker B is closed to supply load N. Breaker C is closed to supply load P. Keys A-1, B-1, and C-1 are held in L-O interlocks of breakers A, B, and C. Tie-breakers D and E are locked open.

Tie-breaker D interlock has a master or apartment lock and can be unlocked for operation with either keys A-1 or B-1. Tie-breaker E has a master or apartment lock and can be unlocked for operation with either keys B-1 or C-1.

To transfer load M from Breaker A to breaker B:

1. Open breaker A
2. Turn key A-1 in L-O interlock on breaker A to lock open. Key A-1 is now free.
3. Insert Key A-1 in L-O interlock on tie-breaker D and turn to unlock. Key A-1 is now held.
4. Close tie-breaker D.

Reverse sequence to restore service through breaker A.

To transfer load M and N from breakers A and B to breaker C:

1. Close tie-breaker D as above.
2. Turn key B-1 in L-O interlock on breaker B to lock open. Key B-1 is now free.
3. Insert key B-1 in L-O interlock on tie-breaker E and turn to unlock. Key B-1 is now held.
4. Close tie-breaker E.

Reverse sequence to restore service (M and N through breakers A and B).

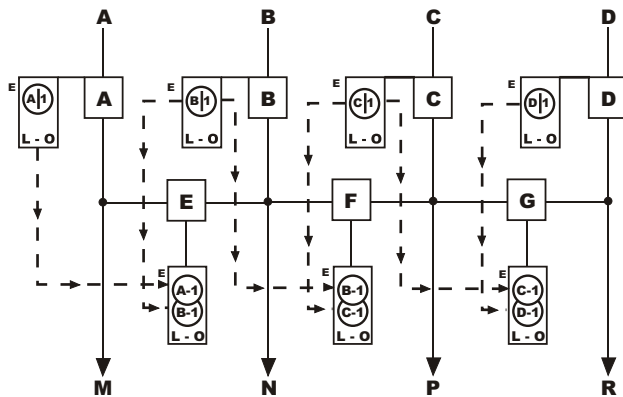
Any of the loads M, N, or P can be transferred from its own supply to any adjacent supply.



Note: This symbol represents an interlock with an "apartment lock". An apartment lock is a single cylinder that will accept two different keys - but only one key at a time.

Scheme 17

To prevent paralleling lines A, B, C, and D. Four loads, fed from any source (three tie-breakers).



Breaker A is closed to supply load M. Breaker B is closed to supply load N. Breaker C is closed to supply load P. Breaker D is closed to supply load R. Keys A-1, B-1, C-1, and D-1 are held in L-O interlocks of breakers A, B, C, and D. Breakers E, F and G are locked open. Breaker E interlock has a master or apartment lock and can be unlocked for operation with either key A-1 or B-1. Breaker F interlock has a master or apartment lock and can be unlocked for operation with either key B-1 or C-1. Breaker G interlock has a master or apartment lock and can be unlocked for operation with either key C-1 or D-1.

To transfer load M from breaker A to breaker B:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O interlock on tie-breaker E and turn to unlock. Key A-1 is now held.
4. Close tie-breaker E.

Reverse sequence to restore service through breaker A.

To transfer load M and N from breaker A and B to breaker C:

1. Close tie-breaker E as above.
2. Open breaker B.
3. Turn key B-1 in L-O interlock on breaker B to lock open. Key B-1 is now free.
4. Insert key B-1 in L-O interlock on tie-breaker F and turn to unlock. Key B-1 is now held.
5. Close tie-breaker F.

Reverse sequence to restore service (M and N) through breakers A and B.

To transfer load R from breaker D to breaker C:

1. Open breaker D.
2. Turn key D-1 in L-O interlock on breaker D to lock open. Key D-1 is now free.
3. Insert key D-1 in L-O interlock on tie-breaker G and turn to unlock. Key D-1 is now held.
4. Close tie-breaker G.

Reverse sequence to restore service through breaker D.

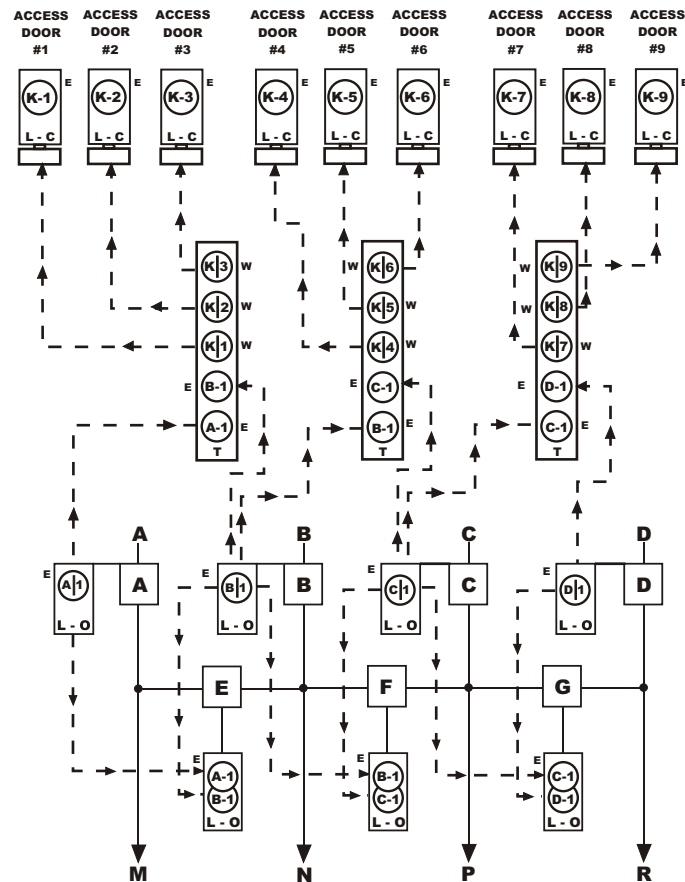
Any of the loads M, N, P, or R can be transferred from its own supply to any adjacent supply.



Note: This symbol represents an interlock with an "apartment lock". An apartment lock is a single cylinder that will accept two different keys - but only one key at a time.

Scheme 17A

To prevent paralleling lines A, B, C, and D. To prevent opening rear access doors when breakers are energized.



Breakers A, B, C, and D are closed to supply their respective loads. Keys A-1, B-1, C-1, and D-1 are held in L-O interlocks of breakers A, B, C, and D. Tie-Breakers E, F, and G are locked open. Breaker E interlock has an apartment lock and can be unlocked for operation with either key A-1 or B-1. Breaker F interlock has an apartment lock and can be unlocked for operation with either key B-1 or C-1. Breaker G interlock has an apartment lock and can be unlocked for operation with either key C-1 or D-1. All rear access doors are locked closed. All keys for rear access doors (K-1 through K-9) are held in transfer interlocks.

All loads can be transferred as described in scheme 17.

To open rear access doors K-1, K-2, and K-3:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open. Key A-1 is now free.
3. Open breaker B.
4. Turn key B-1 in L-O interlock on breaker B to lock open. Key B-1 is now free.
5. Insert key A-1 and B-1 in transfer interlock.
6. Turn key A-1 in transfer interlock. Keys K-1, K-2, and K-3 are now free. Keys A-1 and B-1 are now held.
7. Insert keys K-1, K-2, and K-3 in their respective rear access door interlocks and turn to unlock. Keys K-1, K-2, and K-3 are now held.
8. Open the rear access doors.

Reverse sequence to restore service.

To open rear access doors K-4, K-5 and K-6

1. Open breaker B.
2. Turn key B-1 in L-O interlock on breaker B to lock open. Key B-1 is now free.
3. Open breaker C.
4. Turn key C-1 in L-O interlock on breaker C to lock open. Key C-1 is now free.
5. Insert key B-1 and C-1 in transfer interlock.
6. Turn key B-1 in transfer interlock. Keys K-4, K-5, and K-6 are now free. Keys B-1 and C-1 are now held.
7. Insert keys K-4, K-5, and K-6 in their respective rear access door interlocks and turn to unlock. Keys K-4, K-5, and K-6 are now held.
8. Open the rear access doors.

Reverse sequence to restore service.

To open rear access doors K-7, K-8 and K-9

1. Open breaker C.
2. Turn key C-1 in L-O interlock on breaker C to lock open. Key C-1 is now free.
3. Open breaker D.
4. Turn key D-1 in L-O interlock on breaker D to lock open. Key D-1 is now free.
5. Insert key C-1 and D-1 in transfer interlock.
6. Turn key C-1 in transfer interlock. Keys K-7, K-8, and K-9 are now free. Keys C-1 and D-1 are now held.
7. Insert keys K-7, K-8, and K-9 in their respective rear access door interlocks and turn to unlock. Keys K-7, K-8, and K-9 are now held.
8. Open the rear access doors.

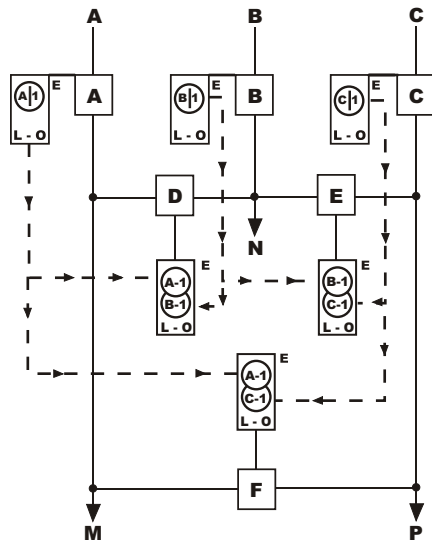
Reverse sequence to restore service.



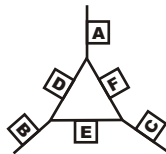
Note: This symbol represents an interlock with an "apartment lock". An apartment lock is a single cylinder that will accept two different keys - but only one key at a time.

Scheme 18

To prevent paralleling of lines A, B, and C. Three loads, fed from any source (three tie-breakers).



Breaker A is closed to supply load M. Breaker B is closed to supply load N. Breaker C is closed to supply load P. Keys A-1, B-1, and C-1 are held in L-O interlocks on breakers A, B and C. Tie-breakers D, E, and F are locked open. Master or apartment lock interlocks are mounted on tie-breakers D, E, and F, and can be unlocked for operation with either keys A-1 or B-1, B-1 or C-1, and A-1 or C-1, respectively.



To transfer load M from breaker A to breaker B:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O interlock on tie-breaker D and turn to unlock. Key A-1 is now held.
4. Close tie-breaker D.

Reverse sequence to restore service through breaker A.

To transfer load M and N from breakers A and B to breaker C:

1. Close tie-breaker D as above.
2. Open breaker B.
3. Turn key B-1 in L-O interlock on breaker B to lock open. Key B-1 is now free.
4. Insert key B-1 in L-O interlock on tie-breaker E and turn to unlock. Key B-1 is now held.
5. Close tie-breaker E.

Reverse sequence to restore service (loads M and N) through breakers A and B.

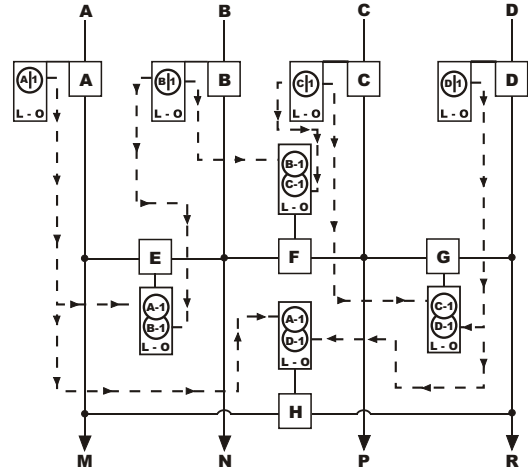
To transfer load P from breaker C to breaker A:

1. Open breaker C.
2. Turn key C-1 in L-O interlock on breaker C to lock open. Key C-1 is now free.
3. Insert key C-1 in L-O interlock on tie breaker F and turn to unlock. Key C-1 is now held.
4. Close tie-breaker F.

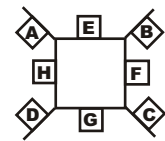
Reverse sequence to restore service through breaker C.

Scheme 19

To prevent paralleling lines A, B, C, and D. Four loads fed from any source (four tie-breakers).



Breaker A is closed to supply load M. Breaker B is closed to supply load N. Breaker C is closed to supply load P. Breaker D is closed to supply load R.



Keys A-1, B-1, C-1, and D-1 are held in L-O interlocks of breakers A, B, C, and D. Tie breakers E, F, G, and H are locked open. Breaker E interlock has a master or apartment lock and can be unlocked with either key A-1 or B-1. Breaker F interlock has a master or apartment lock and can be unlocked with either key B-1 or C-1. Breaker G interlock has a master or apartment lock and can be unlocked with either key C-1 or D-1. Breaker H interlock has a master or apartment lock and can be unlocked with either key A-1 or D-1.

To transfer load M from breaker A to breaker B:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O interlock on tie-breaker E and turn to unlock. Key A-1 is now held.
4. Close tie-breaker E.

Reverse sequence to restore service through breaker A.

To transfer load M and N from breaker A and B to breaker C:

1. Close tie-breaker E as above.
2. Open breaker B.
3. Turn key B-1 in L-O interlock on breaker B to lock open. Key B-1 is now free.
4. Insert key B-1 in L-O interlock on tie-breaker F and turn to unlock. Key B-1 is now held.
5. Close tie-breaker F.

Reverse sequence to restore service (M and N) through breakers A and B.

To transfer load R from breaker D to breaker C:

1. Open breaker D.
2. Turn key D-1 in L-O interlock on breaker D to lock open. Key D-1 is now free.
3. Insert key D-1 in L-O interlock on tie-breaker G and turn to unlock. Key D-1 is now held.
4. Close tie-breaker G.

Reverse sequence to restore service through breaker D.

To transfer load M from breaker A to breaker D:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O interlock on tie-breaker H and turn to unlock. Key A-1 is now held.
4. Close tie-breaker H.

Reverse sequence to restore service through breaker A.

Any of the loads M, N, P, or R can be transferred from its own supply to any adjacent supply.



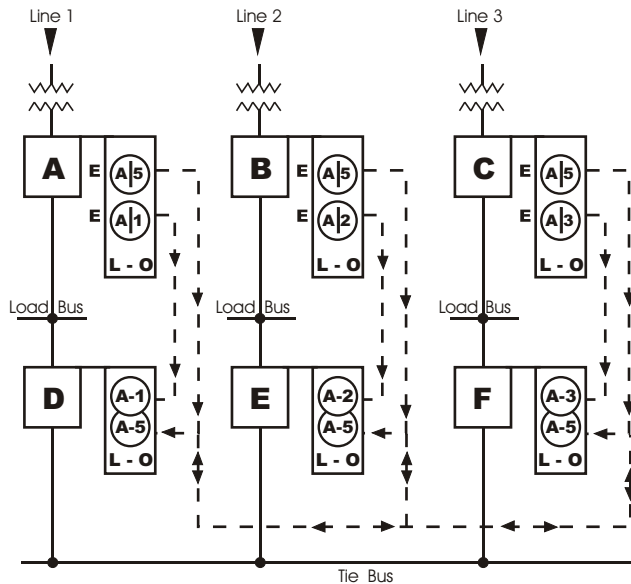
Note: This symbol represents an interlock with an "apartment lock". An apartment lock is a single cylinder that will accept two different keys - but only one key at a time.



Note: This symbol represents an interlock with an "apartment lock". An apartment lock is a single cylinder that will accept two different keys - but only one key at a time.

Scheme 20

To prevent paralleling three power sources through a common tie bus normally in service. To permit feeding any load bus from a second power source through the tie bus. To permit one power source to supply all three load busses through the tie bus.



Breakers A, B, and C are normally closed. Breakers D, E, and F are normally open. Under normal conditions keys A-1 and A-5 are held in breaker A interlock, keys A-2 and A-5 are held in breaker B interlock, and keys A-3 and A-5 are held in breaker C interlock.

To transfer load from line No. 1 to line No. 2 or line No. 3 through the tie bus, proceed as follows:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock breaker open. Keys A-1 and A-5 are now free.
3. Insert key A-1 in L-O interlock on breaker D and turn to unlock. Key A-1 is now held.
4. Close breaker D.
5. Insert key A-5 in L-O interlock on either breaker E or F and turn to unlock. Key A-5 is now held.
6. Close breaker E or F (whichever is selected).

Reverse sequence to restore load to line No. 1.

To transfer load from lines No. 1 and No. 2 to line No. 3 through tie bus, proceed as follows:

1. Close breaker D as per steps 1 to 4 above.
2. Open breaker B.
3. Turn key A-2 in L-O interlock on breaker B to lock breaker open. Keys A-2 and A-5 are now free.
4. Insert key A-2 in L-O interlock on breaker E and turn to unlock. Key A-2 is now held.
5. Close breaker E.
6. Insert one of the A-5 keys from either breaker A or B in L-O interlock on breaker F and turn to unlock. Key A-5 is now held.
7. Close breaker F.

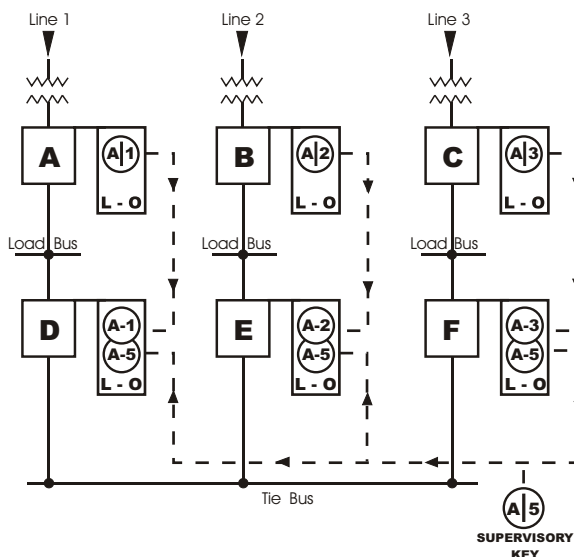
Reverse sequence to restore load to lines No. 1 and No. 2.



Note: This symbol represents an interlock with an "apartment lock". An apartment lock is a single cylinder that will accept two different keys - but only one key at a time.

Scheme 21

To prevent paralleling three power sources through a common tie bus normally in service. To permit feeding any load bus from a second power source through the tie bus only when authorized by supervisor. To permit one power source to supply all three load busses through the tie bus only when authorized by supervisor.



Breakers A, B, and C are normally closed. Breakers D, E, and F are normally open. Under normal conditions key A-1 is held in breaker A interlock, key A-2 is held in breaker B interlock, and key A-3 is held in breaker C interlock. Key A-5 is retained by supervisor.

To transfer load from line No. 1 to line No. 2 or line No. 3 through tie bus, proceed as follows:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock breaker open. Key A-1 is now free.
3. Insert key A-1 in L-O interlock on breaker D and turn to unlock. Key A-1 is now held.
4. Close breaker D.
5. Insert supervisor's key A-5 (only one A-5 is available) in L-O interlock on either breaker E or F and turn to unlock. Key A-5 is now held.
6. Close breaker E or F (whichever is selected).

Reverse sequence to restore load to line No. 1.

To transfer load from lines No. 1 and No. 2 to line No. 3 through tie bus, proceed as follows:

1. Close breaker D as per steps 1 to 4 above.
2. Open breaker B.
3. Turn key A-2 in L-O interlock on breaker B to lock breaker open. Key A-2 is now free.
4. Insert key A-2 in L-O interlock on breaker E and turn to unlock. Key A-2 is now held.
5. Close breaker E.
6. Insert supervisor's key A-5 in L-O interlock on breaker F and turn to unlock. Key A-5 is now held.
7. Close breaker F.

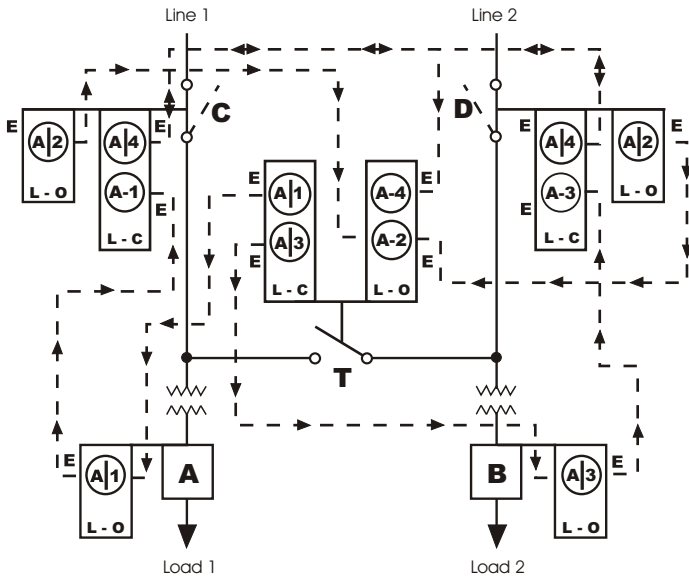
Reverse sequence to restore load to lines No. 1 and No. 2.



Note: This symbol represents an interlock with an "apartment lock". An apartment lock is a single cylinder that will accept two different keys - but only one key at a time.

Scheme 22

To prevent paralleling incoming primary sources, lines 1 and 2, through primary tie bus disconnect. To prevent operation (open or closed) of the disconnects under load. Permits one power source to supply both loads through tie bus.



Under normal conditions breakers A and B are closed, disconnects C and D are locked closed, and tie bus disconnect T is locked open. Keys A-1 are held in L-O interlock on breaker A and L-C interlock on tie bus disconnect T. Keys A-2 are held in L-O interlock on disconnects C and D. Keys A-3 are held in L-O interlock on breaker B and L-C interlock on tie bus disconnect T. Keys A-4 (free keys) are shown removably held in the L-C interlocks on disconnects C and D.

To transfer load No. 1 from line 1 to line 2 through bus tie disconnect T, proceed as follows:

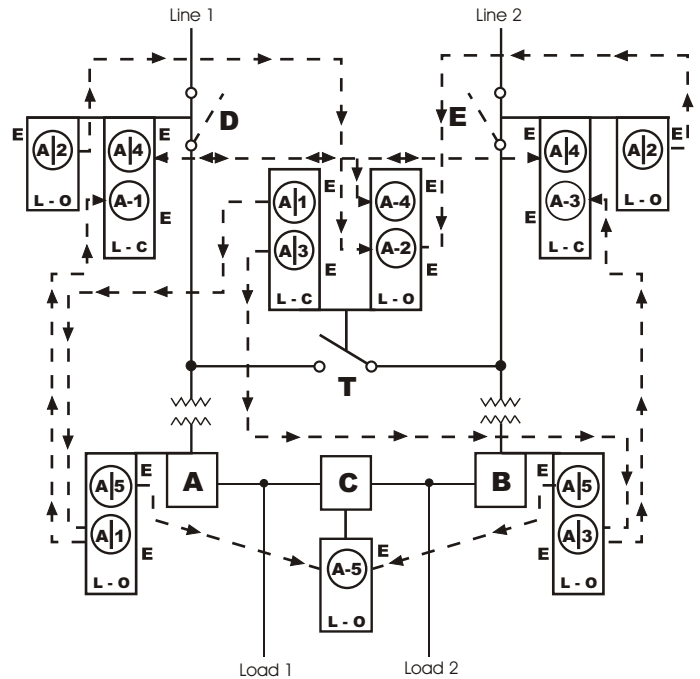
1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open. Key A-1 is now free.
3. Insert key A-1 in L-C interlock on disconnect C and turn to unlock. Keys A-1 and A-4 are now held.
4. Open disconnect C.
5. Turn key A-2 in L-O interlock on disconnect C to lock open. Key A-2 is now free.
6. Insert keys A-2 and free key A-4 (from L-C interlock on disconnect D) in L-O interlock on bus tie disconnect T and turn to unlock. Keys A-2 and A-4 are now held.
7. Close tie bus disconnect T.
8. Turn key A-3 in L-C interlock on disconnect T to lock closed. Keys A-1 and A-3 are now free.
9. Insert key A-1 in L-O interlock on breaker A and turn to unlock. Key A-1 is now held.
10. Close breaker A.

Reverse sequence to restore load No. 1 to line 1. To transfer load No. 2 from line 2 to line 1 through bus tie disconnect T, proceed in a similar manner.

Scheme 23

To prevent paralleling incoming primary sources, lines 1 and 2, through the primary tie bus disconnect or the secondary tie bus breaker. To prevent operation (open or closed) of the disconnects under load. Permits one power source to supply both loads through either the primary or secondary tie bus.

Scheme 23 (Continued)



Under normal conditions breakers A and B are closed, breaker C is locked open, disconnects D and E are locked closed, and tie disconnect T is locked open. Keys A-1 are held in L-O interlock on breaker A and L-C interlock on primary tie bus disconnect T. Keys A-2 are held in L-O interlocks on disconnects D and E. Keys A-3 are held in L-O interlock on breaker B and L-C interlock on primary tie bus disconnect T. Keys A-4 (free keys) are shown removably held in the L-C interlocks on disconnects D and E. Keys A-5 are held in L-O interlocks on breakers A and B.

To transfer load No. 1 from line 1 to line 2 through primary bus tie disconnect T, proceed as follows:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open. Keys A-1 and A-5 are now free.
3. Insert key A-1 and free key A-4 in L-C interlock on disconnect D and turn to unlock. Keys A-1 and A-4 are now held.
4. Open disconnect D.
5. Turn key A-2 in L-O interlock on disconnect D to lock open. Key A-2 is now free.
6. Insert key A-2 and free key A-4 (from L-C interlock on disconnect E) in L-O interlock on primary bus tie disconnect T and turn to unlock. Keys A-2 and A-4 are now held.
7. Close bus tie disconnect T.
8. Turn key A-3 in L-C interlock on bus tie disconnect T to lock closed. Keys A-1 and A-3 are now removable.
9. Insert key A-1 in L-O interlock on breaker A and turn to unlock. Key A-1 is now held.
10. Close breaker A.

Reverse procedure to restore service to line 1. Load No. 2 can be supplied from No. 1 through the primary bus tie in a similar manner.

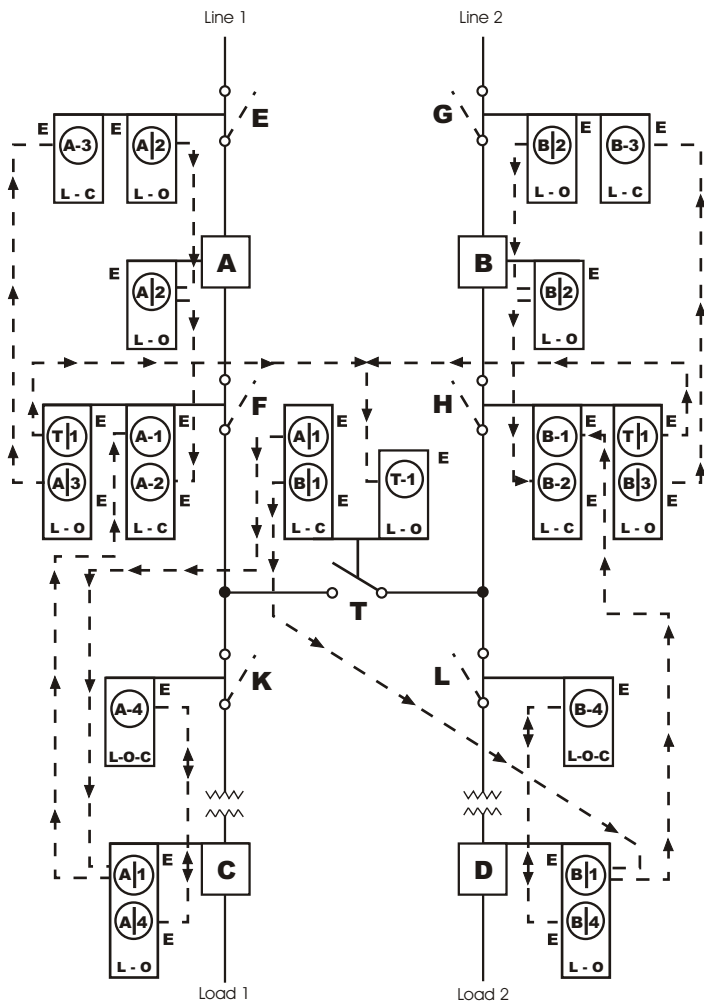
To transfer load No. 1 from line 1 to line 2 through the secondary tie breaker C, proceed as follows:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open. Keys A-1 and A-5 are now removable.
3. Insert key A-5 in L-O interlock on tie breaker C and turn to unlock. Key A-5 is now held.
4. Close tie breaker C.

Reverse procedure to restore service on line 1. Load No. 2 can be supplied from line No. 1 through the secondary tie breaker C in a similar manner.

Scheme 24

To prevent paralleling incoming primary sources, lines 1 and 2. To prevent operation (open or closed) of the disconnects under load. (Permits transformer primary disconnects K & L to open and close the transformer magnetizing current.*) Permits isolating breakers for servicing. Permits one power source to supply both loads through tie bus.



Under normal conditions breakers A, B, C, and D are closed, disconnects E, F, G, H, K, and L are locked closed, and bus tie disconnect T is locked open. Keys A-1 are held in L-O interlock on breaker C and L-C interlock on bus tie disconnect T. Keys A-2 are held in L-O interlocks on breaker A and disconnect E. Key A-3 is held in L-O interlock on disconnect F. Key A-4 is held in L-O interlock on breaker C. Keys B-1 are held in L-O interlock on breaker D and L-C interlock on bus tie disconnect T. Keys B-2 are held in L-O interlocks on breaker B and disconnect G. Key B-3 is held in L-O interlock on disconnect H. Key B-4 is held in L-O interlock on breaker D. Keys T-1 are held in L-O interlock on disconnects F and H.

To transfer load No. 1 from line 1 to line 2 through bus tie disconnect T, proceed as follows:

1. Open breaker A.
2. Turn key A-2 in L-O interlock on breaker A to lock open. Key A-2 is now free.
3. Open breaker C.
4. Turn key A-4 in L-O interlock breaker C to lock open. Keys A-1 and A-4 are now free.
5. Insert key A-2 from L-O interlock on breaker A and key A-1 from L-O interlock on breaker C in L-C interlock on disconnect F and turn to unlock. Keys A-1 and A-2 are now held.
6. Open disconnect F.
7. Turn key A-3 in L-O interlock on disconnect F to lock open. Keys A-3 and T-1 are now free.
8. Insert key T-1 in L-O interlock on bus tie disconnect T and turn to unlock. Key T-1 is now held.
9. Close bus tie disconnect T.
10. Turn key B-1 in L-C interlock on bus tie disconnect T to lock closed. Keys A-1 and B-1 are now free.
11. Insert key A-1 in L-O interlock on breaker C and turn to unlock. Keys A-1 and A-4 are now held.
12. Close breaker C.

Reverse sequence to restore load No. 1 to line 1. To transfer load No. 2 from line 2 to line 1, proceed in a similar manner.

To isolate breaker A for servicing, proceed as follows:

1. Proceed from normal position with operations as in 1 through 7 above.
2. Insert key A-3 in L-C interlock on disconnect E and turn to unlock. Key A-3 is now held.
3. Open disconnect E.
4. Turn key A-2 in L-O interlock on disconnect E to lock open. Key A-2 is now free.
5. Return key A-2 to breaker A and unlock for operation during servicing.

Reverse sequence to restore service. To isolate breaker B for servicing, proceed in a similar manner.

To isolate breaker C for servicing, proceed as follows:

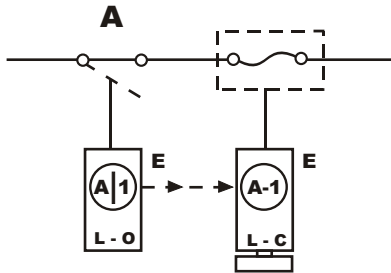
1. Open breaker C.
2. Turn key A-4 in L-O interlock on breaker C to lock breaker open. Keys A-1 and A-4 are now free.
3. Insert key A-4 in L-O-C interlock on disconnect K and turn to unlock. Key A-4 is now held.
4. Open disconnect K.
5. Turn key A-4 in L-O-C interlock on disconnect K to lock open. Key A-4 is now free.
6. Return key A-4 to breaker C and unlock for operation during servicing.

Reverse sequence to restore service. To isolate breaker D for servicing, proceed in a similar manner.

* To prevent primary disconnects K and L from opening magnetizing current only, additional interlocks should be provided for disconnect K and L.

Scheme 25

To prevent opening fuse compartment door when the interrupter switch A is closed. To prevent closing interrupter switch until fuse compartment door is locked closed.



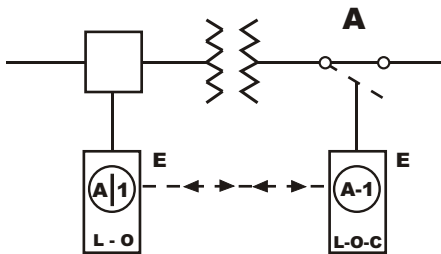
Fuse compartment door and interrupter are shown in closed position. Key A-1 is held in interrupter interlock.

1. Open interrupter.
2. Turn key A-1 in L-O interlock on interrupter switch to lock open. Key A-1 is now free.
3. Insert key A-1 in L-C interlock on fuse compartment door and turn to unlock. Key A-1 is now held.
4. Open fuse compartment door.

Reverse sequence to restore service.

Scheme 26

To prevent operation (open or closed) of interrupter switch A when breaker is closed. Permits the breaker to be serviced and operated while the interrupter switch is locked open.



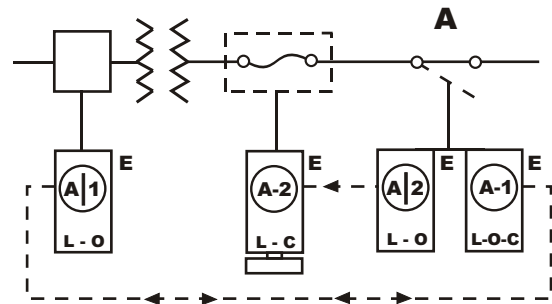
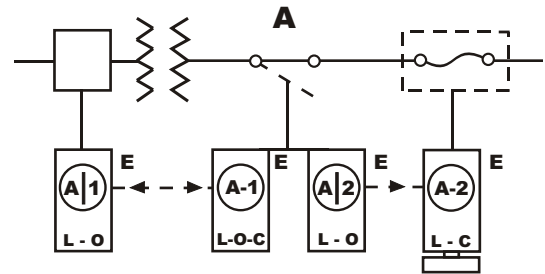
Interrupter and breaker are shown in closed position. Key A-1 is held in breaker interlock.

1. Open breaker.
2. Turn key A-1 in L-O interlock on breaker to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O-C interlock on interrupter and turn to unlock. Key A-1 is now held.
4. Open interrupter.
5. Turn key A-1 in L-O-C interlock on interrupter to lock open. Key A-1 is now free.
6. Return key A-1 to breaker interlock and unlock for operation of breaker during servicing.

Reverse sequence to restore service.

Scheme 27

To prevent operation (open or closed) of interrupter switch A when breaker is closed. To prevent opening fuse compartment door when the interrupter switch A is closed. To prevent closing interrupter switch until fuse compartment door is locked closed. Permits the breaker to be serviced and operated while the interrupter is locked open.



Breaker, fuse compartment door and interrupter are shown in closed position. Key A-1 is held in breaker interlock and key A-2 is held in interrupter interlock.

To service breaker, proceed as follows:

1. Open breaker.
2. Turn key A-1 in L-O interlock on breaker to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O-C interlock on interrupter and turn to unlock. Key A-1 is now held.
4. Open interrupter.
5. Turn key A-1 in L-O-C interlock on interrupter to lock open. Key A-1 is now free.
6. Return key A-1 to breaker interlock and unlock for operation of breaker during servicing.

Reverse sequence to restore service.

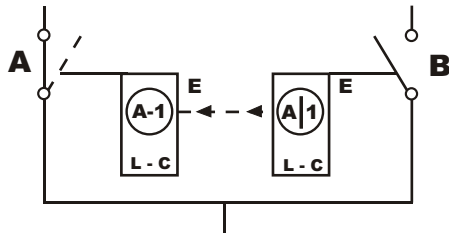
To open fuse compartment door, proceed as follows:

1. Proceed from normal position with operations as in 1 through 4 above.
2. Turn key A-2 in L-O interlock on interrupter switch to lock open. Key A-2 is now free.
3. Insert key A-2 in L-C interlock on fuse compartment door and turn to unlock. Key A-2 is now held.
4. Open fuse compartment door.

Reverse sequence to restore service.

Scheme 28

To prevent dropping load when shifting from one source to the other. To prevent opening both interrupter switches A and B at the same time. Permits both interrupter switches to be closed at the same time.



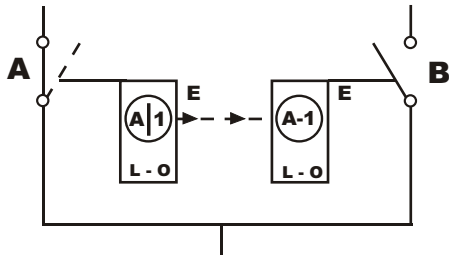
Interrupter switch A is shown closed and interrupter switch B is shown open. Key A-1 is held in interrupter B interlock.

1. Close interrupter B.
2. Turn key A-1 in L-C interlock on interrupter B to lock closed. Key A-1 is now free.
3. Insert key A-1 in L-C interlock on interrupter A and turn to unlock. Key A-1 is now held.
4. Open interrupter A.

Reverse sequence to restore service through interrupter B.

Scheme 29

To prevent paralleling lines A and B requires dropping load when shifting from one source to the other. To prevent closing both interrupter switches A and B at the same time. Permits both interrupter switches to be opened at the same time.



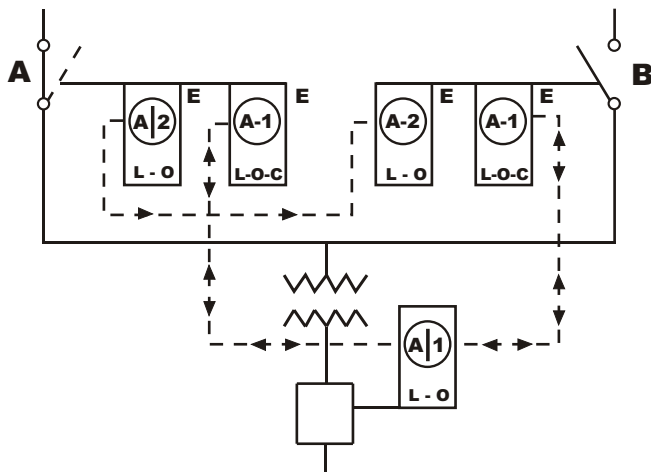
Interrupter switch A is shown closed and interrupter switch B is shown open. Key A-1 is held in interrupter switch A interlock.

1. Open interrupter A.
2. Turn key A-1 in L-O interlock on interrupter A to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O interlock on interrupter B and turn to unlock. Key A-1 is now held.
4. Close interrupter B.

Reverse sequence to restore service through interrupter A.

Scheme 30

To prevent paralleling lines A and B requires dropping load when shifting from one source to the other. To prevent closing both interrupter switches A and B at the same time. Permits both interrupter switches to be opened at the same time. To prevent operation (open or closed) of either interrupter switch when breaker is closed. Permits breaker to be serviced and operated while both interrupter switches are locked open.



Breaker and interrupter A are shown in closed position. Interrupter B is shown in open position. Key A-1 is held in breaker interlock. Key A-2 is held in interrupter A interlock.

To service breaker, proceed as follows:

1. Open breaker.
2. Turn key A-1 in L-O interlock on breaker to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O-C interlock on interrupter A and turn to unlock. Key A-1 is now held.
4. Open interrupter A.
5. Turn key A-1 in L-O-C interlock on interrupter A to lock open. Key A-1 is now free.
6. Return key A-1 to breaker interlock and unlock for operation of breaker during servicing.

Reverse sequence to restore service.

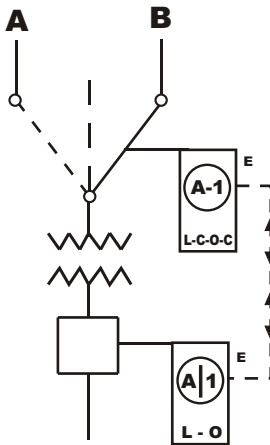
To transfer load from interrupter A to interrupter B:

1. Proceed from normal positions with operations as in 1 through 4 above.
2. Turn key A-1 in L-O-C interlock and key A-2 in L-O interlock on interrupter A to lock open. Keys A-1 and A-2 are now free.
3. Insert key A-1 in L-O-C interlock and key A-2 in L-O interlock on interrupter B and turn to unlock. Keys A-1 and A-2 are now held.
4. Close interrupter B.
5. Turn key A-1 in L-O-C interlock on interrupter B to lock closed. Key A-1 is free and key A-2 is held.
6. Insert key A-1 in L-O interlock on breaker and turn to unlock. Key A-1 is now held.
7. Close breaker.

Reverse sequence to restore service through interrupter A.

Scheme 31

To prevent operation (closed, open, or closed) of interrupter switch when breaker is closed. Permits the breaker to be serviced and operated while the interrupter switch is locked open.



Breaker and interrupter are shown in closed position, connected to line B. Key A-1 is held in breaker interlock.

To service breaker, proceed as follows:

1. Open breaker.
2. Turn key A-1 in L-O interlock on breaker to lock open. Key A-1 is now free.
3. Insert key A-1 in L-C-O-C interlock on interrupter and turn to unlock. Key A-1 is now held.
4. Open interrupter.
5. Turn key A-1 in L-C-O-C interlock on interrupter to lock open. Key A-1 is now free.
6. Return key A-1 to breaker interlock and unlock for operation of breaker during servicing.

Reverse sequence to restore service through either line A or line B.

To transfer interrupter from line B to line A:

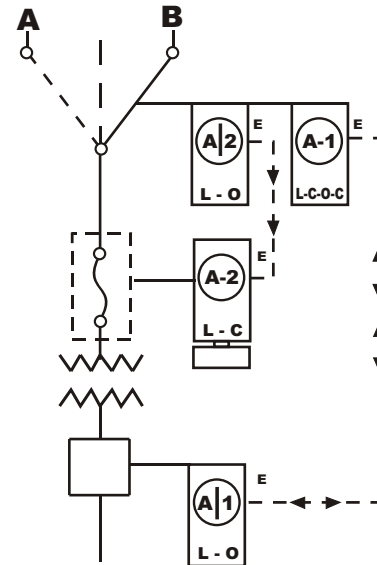
1. Proceed from normal position with operations as in steps 1 through 3 above.
2. Open interrupter switch from line B and connect to line A.
3. Turn key A-1 in L-C-O-C interlock on interrupter to lock closed. Key A-1 is now free.
4. Insert key A-1 in L-O interlock on breaker and turn to unlock. Key A-1 is now held.
5. Close breaker.

Reverse sequence to restore service through line B.

Scheme 32

To prevent operation (closed, open, or closed) of interrupter switch when breaker is closed. To prevent opening fuse compartment door when the interrupter switch A is closed. To prevent closing interrupter switch until fuse compartment door is locked closed. Permits the breaker to be serviced and operated while the interrupter switch is locked open.

Scheme 32 (Continued)



Breaker, fuse compartment door, and interrupter are shown in closed position, connected to line B. Key A-1 is held in breaker interlock and key A-2 is held in interrupter interlock.

To service breaker, proceed as follows:

1. Open breaker.
2. Turn key A-1 in L-O interlock on breaker to lock open. Key A-1 is now free.
3. Insert key A-1 in L-C-O-C interlock on interrupter and turn to unlock. Key A-1 is now held.
4. Open interrupter.
5. Turn key A-1 in L-C-O-C interlock on interrupter to lock open. Key A-1 is now free.
6. Return key A-1 to breaker interlock and unlock for operation of breaker during servicing.

Reverse sequence to restore service through either line A or line B.

To open fuse compartment door:

1. Proceed from normal position with operations 1 through 4 above.
2. Turn key A-2 in L-O interlock on interrupter to lock open. Key A-2 is now free.
3. Insert key A-2 in L-C interlock on fuse compartment door and turn to unlock. Key A-2 is now held.
4. Open fuse compartment door.

Reverse sequence to restore service.

To transfer interrupter from line B to line A:

1. Proceed from normal position with operations as in steps 1 through 3 above.
2. Open interrupter switch from line B and connect to line A.
3. Turn key A-1 in L-C-O-C interlock on interrupter to lock closed. Key A-1 is now free.
4. Insert key A-1 in L-O interlock on breaker and turn to unlock. Key A-1 is now held.
5. Close breaker.

Reverse sequence to restore service through line B.

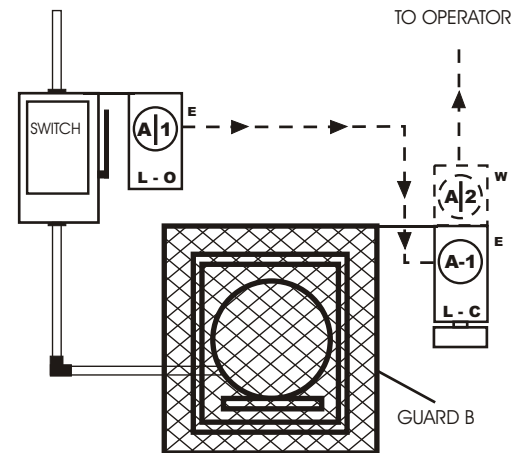
Scheme 33

To prevent opening of guard B with motor circuit closed.

Starting switch normally closed. Key A-1 is held in starting switch interlock. Guard B (or door) is locked closed by means of type D (detachable) interlock.

1. Open starting switch.
2. Turn key A-1 in L-O interlock on switch to lock open. Key A-1 is now free.
3. Insert key A-1 in L-C interlock (type D) on guard B and turn to unlock. Key A-1 is now held.
4. Open guard. Service person can remove key A-2 and hold until the service is complete. Thereby ensuring that the key sequence cannot be reversed until the guard is locked closed again.

Reverse sequence to restore service.



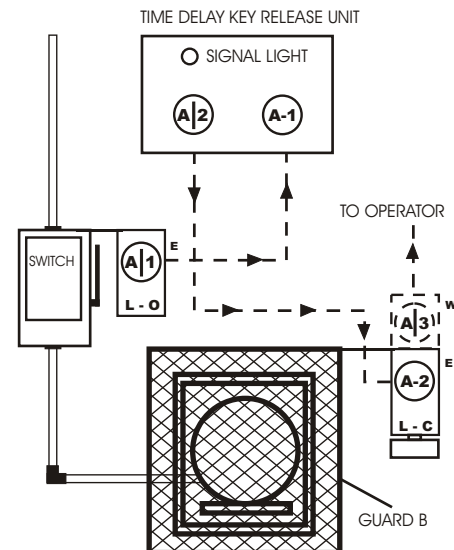
Scheme 34

To prevent opening of guard B for a pre-determined time after removal of power.

Starting switch normally closed. Key A-1 is held in starting switch interlock. Guard B (or door) is locked closed by means of type D (detachable) interlock.

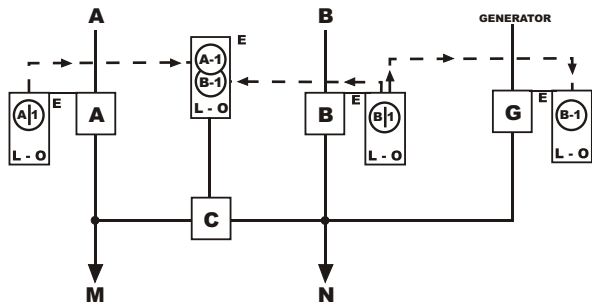
1. Open starting switch.
2. Turn key A-1 in L-O interlock on switch to lock open. Key A-1 is now free.
3. Insert key A-1 in time delay key release unit (type TDKRU) and rotate to start the time delay action.
4. Signal light energized and key A-2 can be removed after the prescribed time elapses. Key A-1 is now held.
5. Insert key A-2 in L-C interlock (type D) on guard B and turn to unlock. Key A-2 is now held.
6. Open guard. Service person can remove key A-3 and hold until the service is complete. Thereby ensuring that the key sequence cannot be reversed until the service is complete and the guard is locked closed again.

Reverse sequence to restore service.



Scheme 35

To prevent paralleling of any sources while allowing switching of the loads to alternate sources.



Breaker A is closed to supply load M. Breaker B is closed to supply load N. Tie-Breaker C and generator breaker G are locked open. Key A-1 is held in the L-O interlock on breaker A. Key B-1 is held in the L-O interlock on breaker B. Tie-Breaker C cannot be closed unless either breaker A or B is locked open. Generator breaker G cannot be closed unless breaker B is locked open. Tie-Breaker C interlock has an apartment lock and can be unlocked for operation with either key A-1 or B-1. Generator breaker G interlock can be unlocked for operation with key B-1 only.

To transfer load N to breaker A, proceed as follows:

1. Open breaker B.
2. Turn key B-1 in L-O interlock on breaker B to lock open. Key B-1 is now free.
3. Insert Key B-1 in L-O interlock on tie-breaker C and turn to unlock. Key B-1 is now held.
4. Close tie-breaker C.

Reverse sequence to restore service through breaker B. Load M can be supplied through breaker B in a similar manner.

To transfer load N to the generator, proceed as follows:

1. Open breaker B.
2. Turn key B-1 in L-O interlock on breaker B to lock open. Key B-1 is now free.
3. Insert key B-1 in L-O interlock on generator breaker G and turn to unlock. Key B-1 is now held.
4. Close generator breaker G.

Reverse sequence to restore service through breaker B.

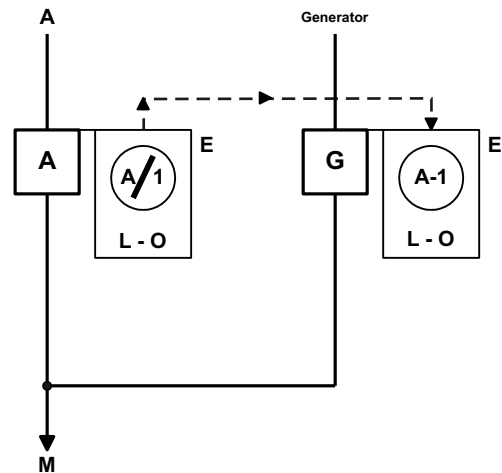
To transfer loads M and N to the generator, proceed as follows:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open. Key A-1 is now free.
3. Open breaker B.
4. Turn key B-1 in L-O interlock on breaker B to lock open. Key B-1 is now free.
5. Insert key A-1 in L-O interlock on tie-breaker C and turn to unlock. Key A-1 is now held.
6. Close tie-breaker C.
7. Insert key B-1 in L-O interlock on generator breaker G and turn to unlock. Key B-1 is now held.
8. Close generator breaker G.

Reverse sequence to restore service through breakers A and B.

Scheme 35A

To prevent closing the generator breaker when the main breaker is closed.



Breaker A is closed to supply load M. Key A-1 is held in the L-O interlock on breaker A. Generator breaker G is locked open and cannot be closed until breaker A is locked open.

To transfer load M to the generator, proceed as follows:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O interlock on breaker G and turn to unlock. Key A-1 is now held.
4. Close breaker G.

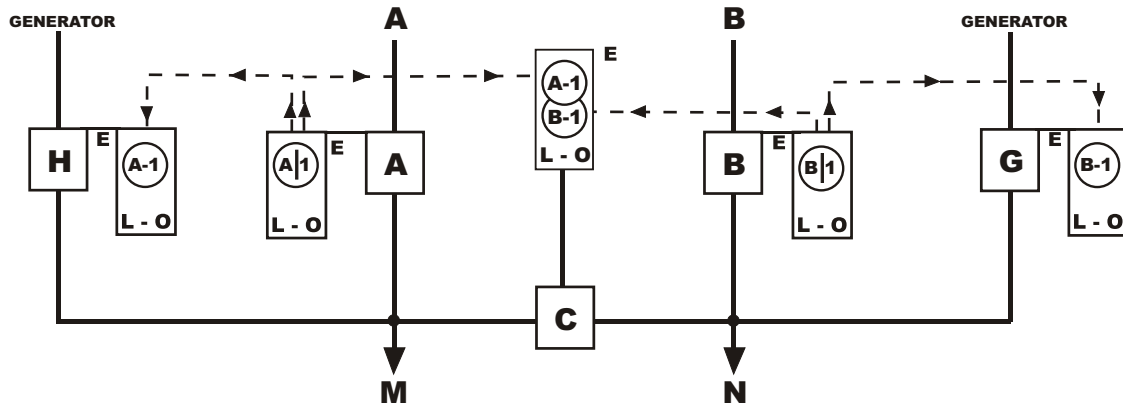
Reverse sequence to restore service through breaker A.



Note: This symbol represents an interlock with an "apartment lock". An apartment lock is a single cylinder that will accept two different keys - but only one key at a time.

Scheme 36

To prevent paralleling of any sources while allowing switching of the loads to alternate sources.



Breaker A is closed to supply load M. Breaker B is closed to supply load N. Tie-Breaker C and generator breakers G and H are locked open. Key A-1 is held in the L-O interlock on breaker A. Key B-1 is held in the L-O interlock on breaker B. Tie-Breaker C cannot be closed unless either breaker A or breaker B is locked open. Generator breaker G cannot be closed unless breaker B is locked open. Generator breaker H cannot be closed unless breaker A is locked open. Tie-Breaker C interlock has an apartment lock and can be unlocked for operation with either key A-1 or B-1. Generator G breaker interlock can be unlocked for operation with key B-1 only. Generator H breaker interlock can be unlocked for operation with Key A-1 only.

To transfer load N to breaker A, proceed as follows:

1. Open breaker B.
2. Turn key B-1 in L-O interlock on breaker B to lock open. Key B-1 is now free.
3. Insert Key B-1 in L-O interlock on tie-breaker C and turn to unlock. Key B-1 is now held.
4. Close tie-breaker C.

Reverse sequence to restore service through breaker B. Load M can be supplied through breaker B in a similar manner.

To transfer load M to generator H, proceed as follows:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open.

Key A-1 is now free.

3. Insert key A-1 in L-O interlock on generator breaker H and turn to unlock. Key A-1 is now held.
4. Close generator breaker H.

Reverse sequence to restore service through breaker A.

Load N can be transferred to generator G using the B-1 key in a similar manner.

To transfer loads M and N to generator H, proceed as follows:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open. Key A-1 is now free.
3. Open breaker B.
4. Turn key B-1 in L-O interlock on breaker B to lock open. Key B-1 is now free.
5. Insert key B-1 in L-O interlock on tie-breaker C and turn to unlock. Key B-1 is now held.
6. Close tie-breaker C.
7. Insert key A-1 in L-O interlock on generator breaker H and turn to unlock. Key A-1 is now held.
8. Close generator breaker H.

Reverse sequence to restore service through breakers A and B.

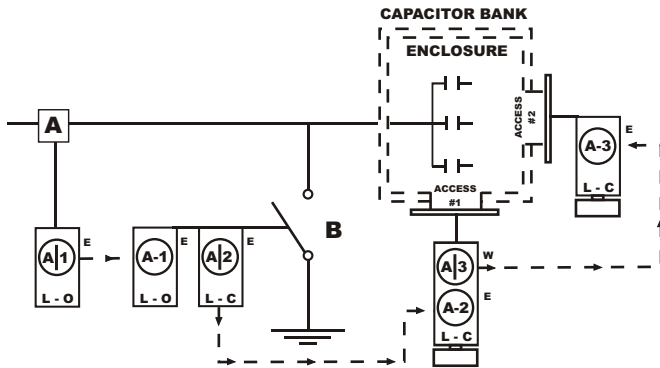
Loads M and N can be transferred to generator G in a similar manner. Open breakers A & B, then utilize the A-1 key to unlock tie-breaker C and utilize the B-1 key to unlock generator breaker G.



Note: This symbol represents an interlock with an "apartment lock". An apartment lock is a single cylinder that will accept two different keys - but only one key at a time.

Scheme 37

To prevent closing ground switch B under load and to enable access to the capacitor bank enclosure only after the capacitor bank has been grounded and discharged.



Capacitor bank scheme without time delay.

Breaker A is closed. Ground switch B is locked open. All capacitor bank enclosure doors are locked closed. Key A-1 is held in L-O interlock on breaker A. Key A-2 is held in L-C interlock on ground switch B. Key A-3 is held in L-C interlock (Type M2D) on access door #1.

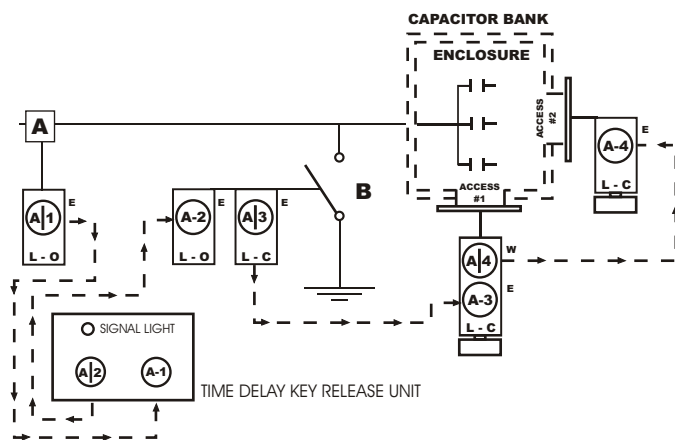
To gain access to capacitor bank enclosure, proceed as follows:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open. Key A-1 is now free.
3. Insert key A-1 in L-O interlock on ground switch B and turn to unlock. Close ground switch B. Key A-1 is now held.
4. Turn key A-2 in L-C interlock on ground switch B to lock closed. Key A-2 is now free.
5. Insert key A-2 in L-C interlock (Type M2D) on capacitor bank enclosure access door #1 and turn to unlock. Key A-2 is now held and key A-3 is now free.
6. Open access door #1 to enter capacitor bank enclosure.
7. Insert key A-3 in L-C interlock (Type D) on access door #2 and turn to unlock. Key A-3 is now held.
8. Open access door #2 to enter capacitor bank enclosure.

Reverse sequence to restore service.

Scheme 38

To prevent closing ground switch B under load and to enable access to the capacitor bank enclosure only after the capacitor bank has been grounded and discharged.



Capacitor bank scheme with time delay.

Breaker A is closed. Ground switch B is locked open. All capacitor bank enclosure doors are locked closed. Key A-1 is held in L-O interlock on breaker A. Key A-2 is held in Time Delay Key Release Unit (TDKRU). Key A-3 is held in L-C interlock on ground switch B. Key A-4 is held in L-C interlock (Type M2D) on access door #1.

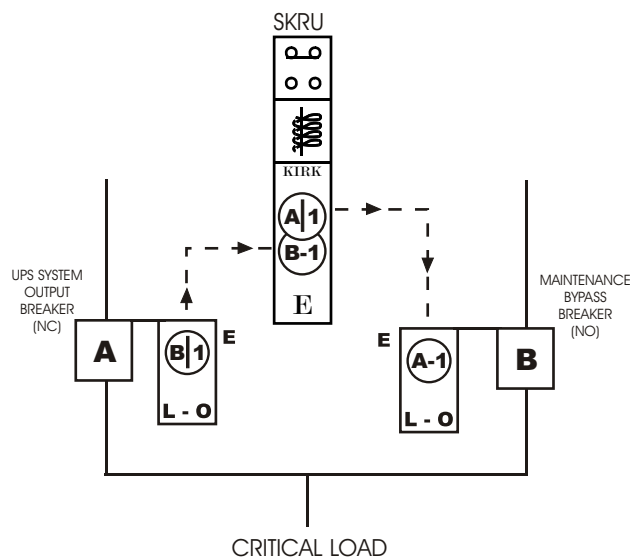
To gain access to capacitor bank enclosure, proceed as follows:

1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock open. Key A-1 is now free.
3. Insert Key A-1 in initiating lock on TDKRU. Turn key to start time delay action.
4. Signal light energized and key A-2 can be removed after the prescribed time period. Key A-1 is now held.
5. Insert key A-2 in L-O interlock on ground switch B and turn to unlock. Close ground switch B. Key A-2 is now held.
6. Turn key A-3 in L-C interlock on ground switch B to lock closed. Key A-3 is now free.
7. Insert key A-3 in L-C interlock (Type M2D) on capacitor bank enclosure access door #1 and turn to unlock. Key A-3 is now held and key A-4 is now free.
8. Open access door #1 to enter capacitor bank enclosure.
9. Insert key A-4 in L-C interlock (Type D) on access door #2 and turn to unlock. Key A-4 is now held.
10. Open access door #2 to enter capacitor bank enclosure.

Reverse sequence to restore service.

Scheme 39

To prevent improper maintenance bypass of Uninterruptible Power Supply.



Solenoid Key Release Unit (SKRU) shown with A-1 Key held captive. UPS output breaker A is closed supplying the critical load through the UPS. Key B-1 is held captive in the L-O interlock on breaker A. Maintenance bypass breaker B cannot be closed until the UPS is placed in bypass mode, sending a signal to the SKRU allowing release of key A-1. The SKRU has an apartment lock that will accept either key A-1 or B-1.

To supply critical load through the maintenance bypass breaker, proceed as follows:

1. Place the UPS in bypass mode.
2. Upon receipt of the proper signal, key A-1 in SKRU can be turned changing status of SKRU internal contacts and releasing key A-1.
3. Insert key A-1 in L-O interlock on maintenance bypass breaker B and turn to unlock.
4. Close maintenance bypass breaker B. Key A-1 is now held.
5. Open UPS output breaker A.
6. Turn key B-1 in interlock on UPS output breaker A to lock open. Key B-1 is now free.
7. Insert key B-1 in SKRU and turn to return the SKRU internal contacts to the original position. Key B-1 is now held in the SKRU.

Reverse sequence to restore equipment to original condition.

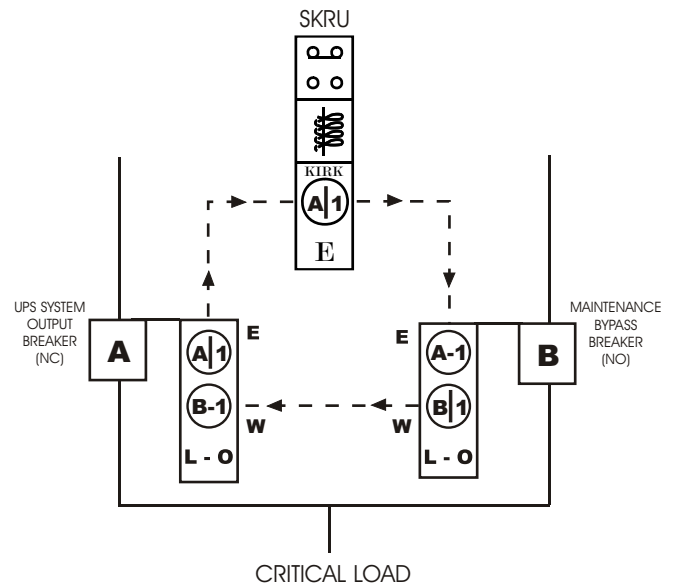
Note: Refer to UPS manufacturer's operation and maintenance manual for instructions regarding transferring the load to the UPS maintenance bypass source. Persons not familiar with the operation of the UPS system should not attempt to change the position the above devices.



Note: This symbol represents an interlock with an "apartment lock". An apartment lock is a single cylinder that will accept two different keys - but only one key at a time.

Scheme 40

To prevent improper maintenance bypass of Uninterruptible Power Supply.



Solenoid Key Release Unit (SKRU) shown with A-1 Key held captive. UPS output breaker A is closed supplying the critical load through the UPS. A second key A-1 is held captive in the L-O interlock on breaker A. Key B-1 is held captive in L-O interlock on maintenance bypass breaker B. Maintenance bypass breaker B cannot be closed until the UPS is placed in bypass mode, sending a signal to the SKRU allowing release of SKRU key A-1.

To supply critical load through the maintenance bypass breaker, proceed as follows:

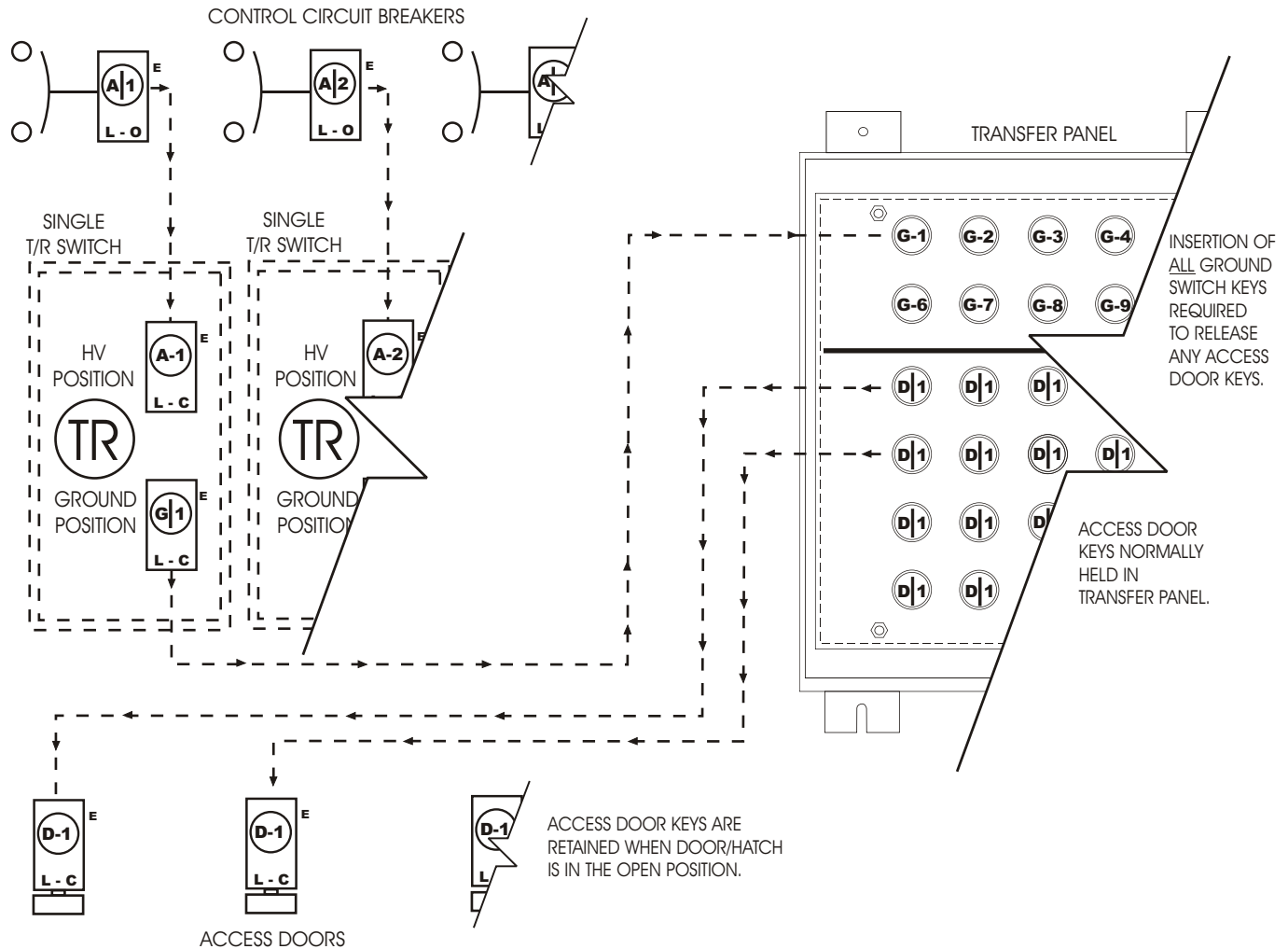
1. Place the UPS in bypass mode.
2. Upon receipt of the proper signal, key A-1 in SKRU can be turned changing status of SKRU internal contacts and releasing key A-1.
3. Insert key A-1 in L-O interlock on maintenance bypass breaker B and turn to unlock.
4. Close maintenance bypass breaker B. Key A-1 is now held. Key B-1 is now free.
5. Open UPS output breaker A.
6. Insert key B-1 in interlock on UPS output breaker A and turn to lock open. Key B-1 is now held. Key A-1 is now free.
7. Insert key A-1 in SKRU and turn returning the SKRU internal contacts to the original position. Key A-1 is now held in the SKRU.

Reverse sequence to restore equipment to original condition.

Note: Refer to UPS manufacturer's operation and maintenance manual for instructions regarding transferring the load to the UPS maintenance bypass source. Persons not familiar with the operation of the UPS system should not attempt to change the position of the above devices.

Scheme 41

To prevent opening any access doors of an electrostatic precipitator until all power supplies are de-energized and properly grounded.



Precipitator scheme with single output transformer rectifiers.

All main breakers in ESP control room are closed to supply all transformer rectifiers. All A keys (A-1, A-2, A-3, etc.) are held in L-O interlocks on the breakers. All transformer rectifiers are locked in the ON position. All G keys (G-1, G-2, etc.) are held in L-C interlocks on the ground position of the transformer rectifiers. All access doors are locked closed and all access door keys are held in the transfer panel (key exchange box).

To open all access doors:

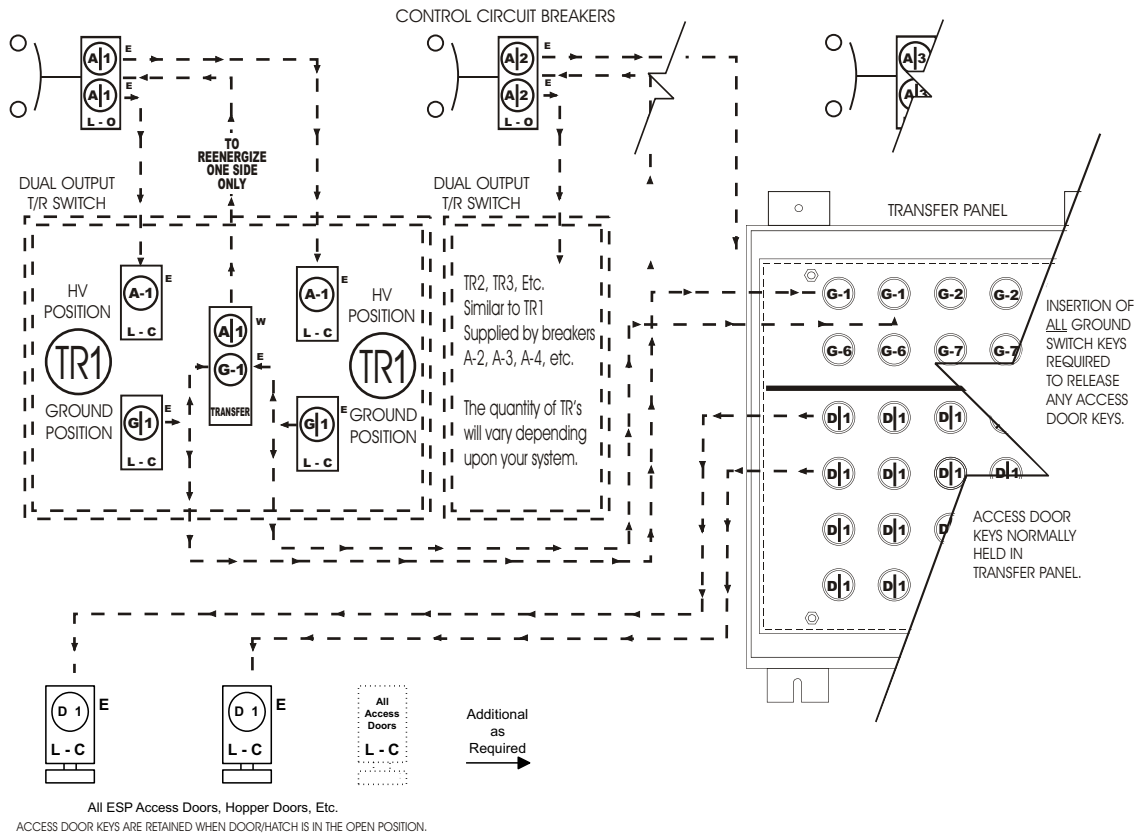
1. Open breaker A-1.
2. Turn key A-1 in L-O interlock to lock breaker in the open position. Key A-1 is now free.
3. Lock open all other breakers and free all A keys (A-2, A-3, A-4, etc.).
4. Insert all A keys in the L-C interlocks on the HV position of each TR. Turn A keys to unlock. All A keys are now held.
5. Rotate all TR handles to the ground position.
6. Turn all G keys (G-1, G-2, G-3, etc.) in L-C interlocks of each TR to lock all TR handles in the ground position. All G keys are now free.
7. Insert all G keys in the transfer panel (key exchange box) and turn. All G keys are now held.
8. Turn and remove the D-1 keys from the transfer panel. Note: D-1 keys are secondary keys and cannot be removed until all primary keys (G keys) are inserted and turned.
9. Insert the D-1 keys in each access door interlock and turn to unlock. The D-1 keys will remain held in each access door interlock as long as the door is open.

To restore service, close and lock all access doors, return all D-1 keys to the transfer panel and reverse the above sequence.

The scheme above represents basic guidelines regarding the proper interlock sequence for an Electro-Static Precipitator. The equipment that comprises an E.S.P., or Baghouse can vary depending upon the manufacturer and age of the equipment. Let us know your specific needs and we will be glad to provide a free proposal without obligation.

Scheme 42

To allow operation of dual output transformer rectifiers with one field removed from service and to prevent opening any access doors of an electrostatic precipitator until all power supplies are de-energized and properly grounded.



Precipitator scheme with dual output transformer rectifiers.

All main breakers in ESP control room are closed to supply all transformer rectifiers. All A keys (A-1, A-2, A-3, etc.) are held in L-O interlocks on the breakers (note: one A key is held in a transfer block on each TR). All transformer rectifiers are locked in the ON position. All G keys (G-1, G-2, etc.) are held in L-C interlocks on the ground position of the transformer rectifiers. All access doors are locked closed and all access door keys are held in the transfer panel (key exchange box).

To ground one field of TR1, proceed as follows:

1. Open breaker A-1.
2. Turn key A-1 in L-O interlock to lock breaker in open position. Both A-1 keys are now free.
3. Insert one A-1 key in L-C interlock on HV position of the field to be removed from service. Turn key to unlock. Key A-1 is now held.
4. Rotate TR1 handle to ground position.
5. Turn key G-1 in L-C interlock locking the TR handle in the ground position. Key G-1 is now free.
6. Insert key G-1 in the transfer block and turn. Key G-1 is now held and key A-1 is free.
7. Insert key A-1 in L-O interlock on the breaker and turn to unlock. Both A-1 keys are now held.
8. Close breaker A-1.

Other fields can be removed from service in the same manner. Reverse sequence to restore service.

To open all access doors:

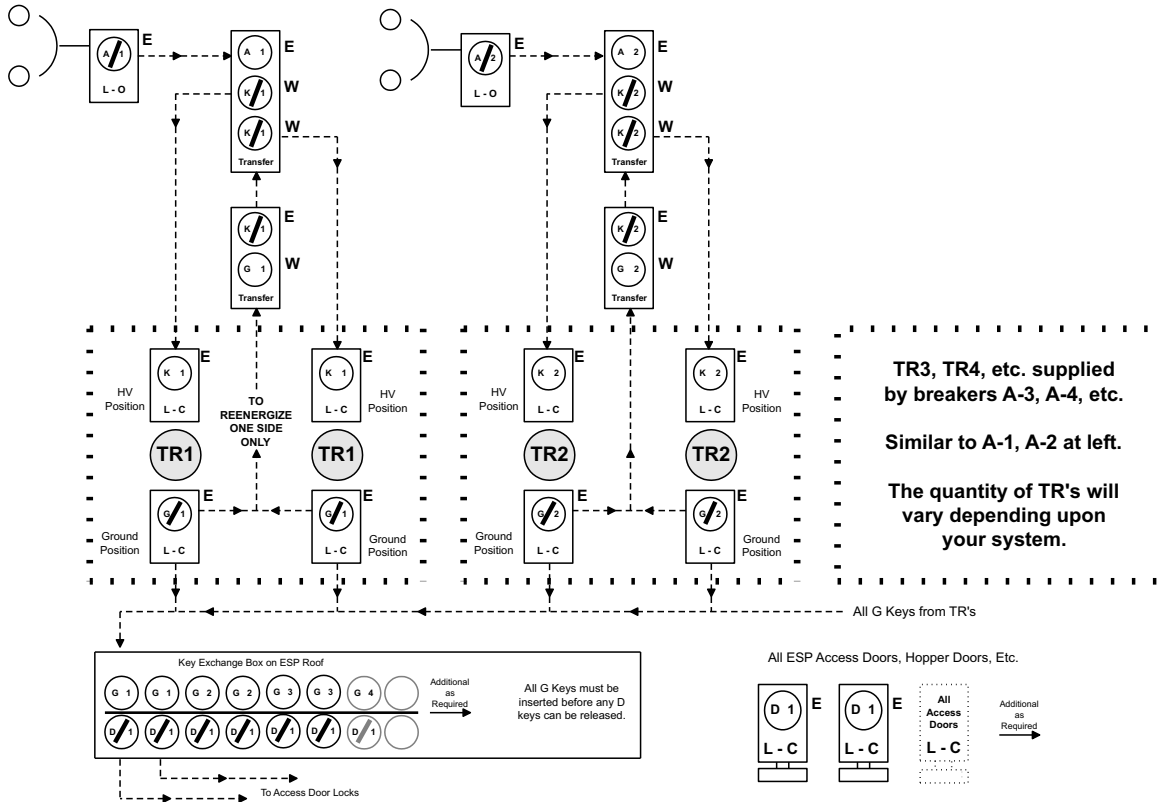
1. Open breaker A-1.
2. Turn key A-1 in L-O interlock to lock breaker in the open position. Both A-1 keys are now free.
3. Lock open all other breakers and free all A keys (A-2, A-3, A-4, etc.).
4. Insert all A keys in the L-C interlocks on the HV position of each TR. Turn A keys to unlock. All A keys are now held.
5. Rotate all TR handles to the ground position.
6. Turn all G keys (G-1, G-2, G-3, etc.) in L-C interlocks of each TR to lock all TR handles in the ground position. All G keys are now free.
7. Insert all G keys in the transfer panel (key exchange box) and turn. All G keys are now held.
8. Turn and remove the D-1 keys from the transfer panel. Note: D-1 keys are secondary keys and cannot be removed until all primary keys (G keys) are inserted and turned.
9. Insert the D-1 keys in each access door interlock and turn to unlock. The D-1 keys will remain held in each access door interlock as long as the door is open.

To restore service, close and lock all access doors, return all D-1 keys to the transfer panel and reverse the above sequence.

The scheme above represents basic guidelines regarding the proper interlock sequence for an Electro-Static Precipitator. The equipment that comprises an E.S.P., or Baghouse can vary depending upon the manufacturer and age of the equipment. Let us know your specific needs and we will be glad to provide a free proposal without obligation.

Scheme 42A

To allow operation of dual output transformer rectifiers with one field removed from service and to prevent opening any access doors of an electrostatic precipitator until all power supplies are de-energized and properly grounded.



All main breakers in ESP control room are closed to supply all transformer rectifiers. All A keys (A-1, A-2, A-3, etc.) are held in L-O interlocks on the breakers. All transformer rectifiers are locked in the ON position. All K keys (K-1, K-2, etc.) are held in transfer blocks. All G keys (G-1, G-2, etc.) are held in L-C interlocks on the ground position of the transformer rectifiers. All access doors are locked closed and all access door keys are held in the transfer panel (key exchange box).

To ground one field of TR1, proceed as follows:

1. Open breaker A-1.
2. Turn key A-1 in L-O interlock to lock breaker in open position. Key A-1 is now free.
3. Insert key A-1 in the three-cylinder transfer block and turn. Key A-1 is now held and both K-1 keys are free.
4. Insert one K-1 key in L-C interlock on HV position of the field to be removed from service. Turn key to unlock. Key K-1 is now held.
5. Rotate TR handle to ground position.
6. Turn key G-1 in L-C interlock locking the TR handle in the ground position. Key G-1 is now free.
7. Insert key G-1 in the two-cylinder transfer block and turn. Key G-1 is now held and key K-1 is now free. Insert key K-1 in the three cylinder transfer block and turn. Both K-1 keys are now held and the A-1 key is now free.
8. Insert key A-1 in L-O interlock on the breaker and turn to unlock. Key A-1 is now held.
9. Close breaker A-1.

Other fields can be removed from service in the same manner. Reverse sequence to restore service.

To open all access doors:

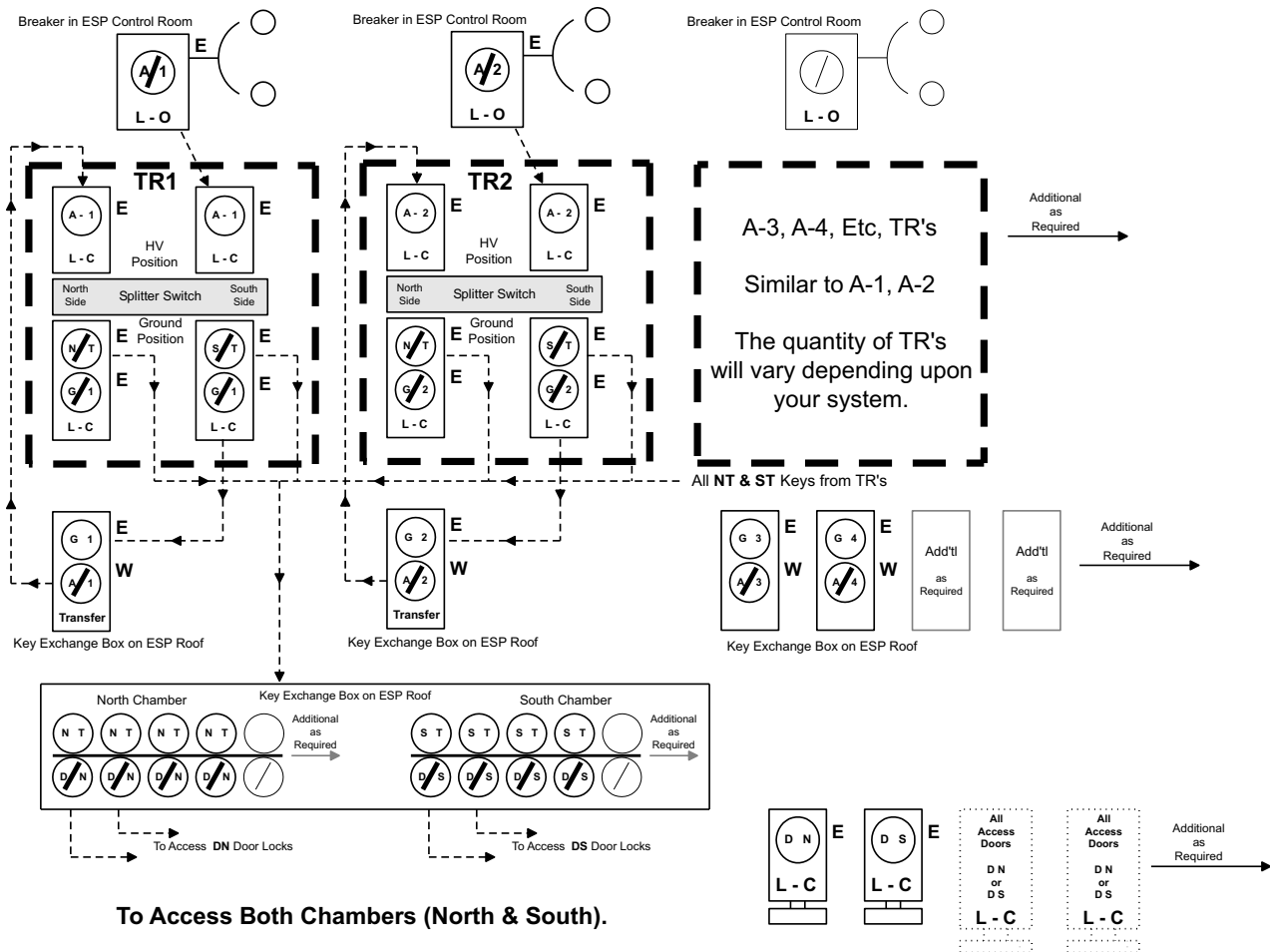
1. Open breaker A-1.
2. Turn key A-1 in L-O interlock to lock breaker in the open position. Key A-1 is now free.
3. Lock open all other breakers and free all A keys (A-2, A-3, A-4, etc.).
4. Insert all A keys in their respective three-cylinder transfer blocks and turn. All A keys are now held and all K keys (K-1, K-2, K-3, etc.) are free.
5. Insert all K keys in the L-C interlocks on the HV position of each TR. Turn K keys to unlock. All K keys are now held.
6. Rotate all TR handles to the ground position.
7. Turn all G keys (G-1, G-2, G-3, etc.) in L-C interlocks of each TR to lock all TR handles in the ground position. All G keys are now free.
8. Insert all G keys in the transfer panel (key exchange box) and turn. All G keys are now held.
9. Turn and remove the D-1 keys from the transfer panel. Note: D-1 keys are secondary keys and cannot be removed until all primary keys (G keys) are inserted and turned.
10. Insert the D-1 keys in each access door interlock to be opened and turn to unlock. The D-1 keys will remain held in each access door interlock as long as the door is open.

To restore service, close and lock all access doors, return all D-1 keys to the transfer panel and reverse the above sequence.

The scheme above represents basic guidelines regarding the proper interlock sequence for an Electro-Static Precipitator. The equipment that comprises an E.S.P., or Baghouse can vary depending upon the manufacturer and age of the equipment. Let us know your specific needs and we will be glad to provide a free proposal without obligation.

Scheme 42B

To allow operation of dual output transformer rectifiers with one field removed from service and to prevent opening any access doors of an electrostatic precipitator until all power supplies are de-energized and properly grounded.



All main breakers in ESP control room are closed to supply all transformer rectifiers. All A keys (A-1, A-2, A-3, etc.) are held in L-O interlocks on the breakers. All TR splitter switches are locked in the ON position. All G keys (G1, G2, etc.), NT and ST keys are held in the L-C interlocks on the ground position of the TR splitter switches. An additional A key for each main breaker is held in the transfer panel (key exchange box). All access doors are locked closed and all access door keys (DN & DS) are held in the transfer panel.

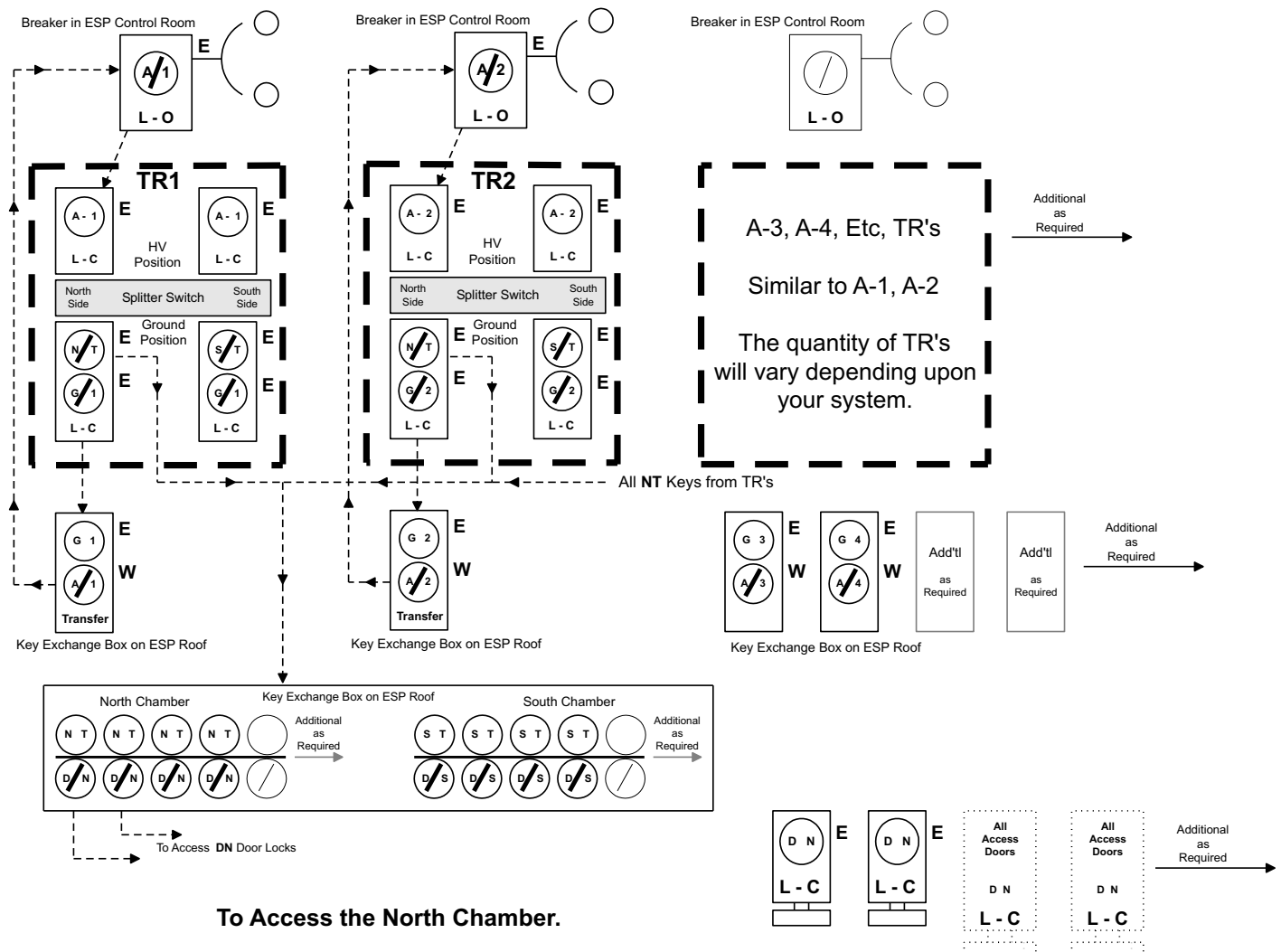
To access both "North" and "South" chambers:

1. Open breaker A-1.
2. Turn key A-1 in L-O interlock to lock breaker in the open position. Key A-1 is now free.
3. Lock open all other breakers and free all A keys (A-2, A-3, A-4, etc.).
4. Insert all A keys in their respective L-C interlocks on the "South" side of each TR splitter switch and turn to unlock. All A keys are now held.
5. Rotate each TR "South" side splitter switch handle to the ground position.
6. Turn the ST key in each L-C interlock locking each switch handle in the ground position. All ST and "South" side G keys are now free.
7. Insert all "South" side G keys (G1, G2, etc.) into the transfer panel and turn to release all A keys. The G keys are now held.
8. Remove all A keys and insert each key in the respective L-C interlocks on the "North" side of each TR splitter switch and turn to unlock. All A keys are now held.
9. Rotate each TR "North" side splitter switch handle to the ground position.
10. Turn the NT key in each L-C interlock locking each switch handle in the ground position. All NT and "North" side G keys are now free.
11. Insert all NT and ST keys in the transfer panel to release all DN and DS keys. Turn and remove the DN and DS keys from the transfer panel.
12. Insert the DN and DS keys in each access door interlock to be opened and turn to unlock. The DN and DS keys will remain held in each access door interlock as long as the door is open.

To restore service to both chambers, close and lock all access doors, return all DN and DS keys to the transfer panel and reverse the above sequence.

Continued Next Page

Scheme 42B



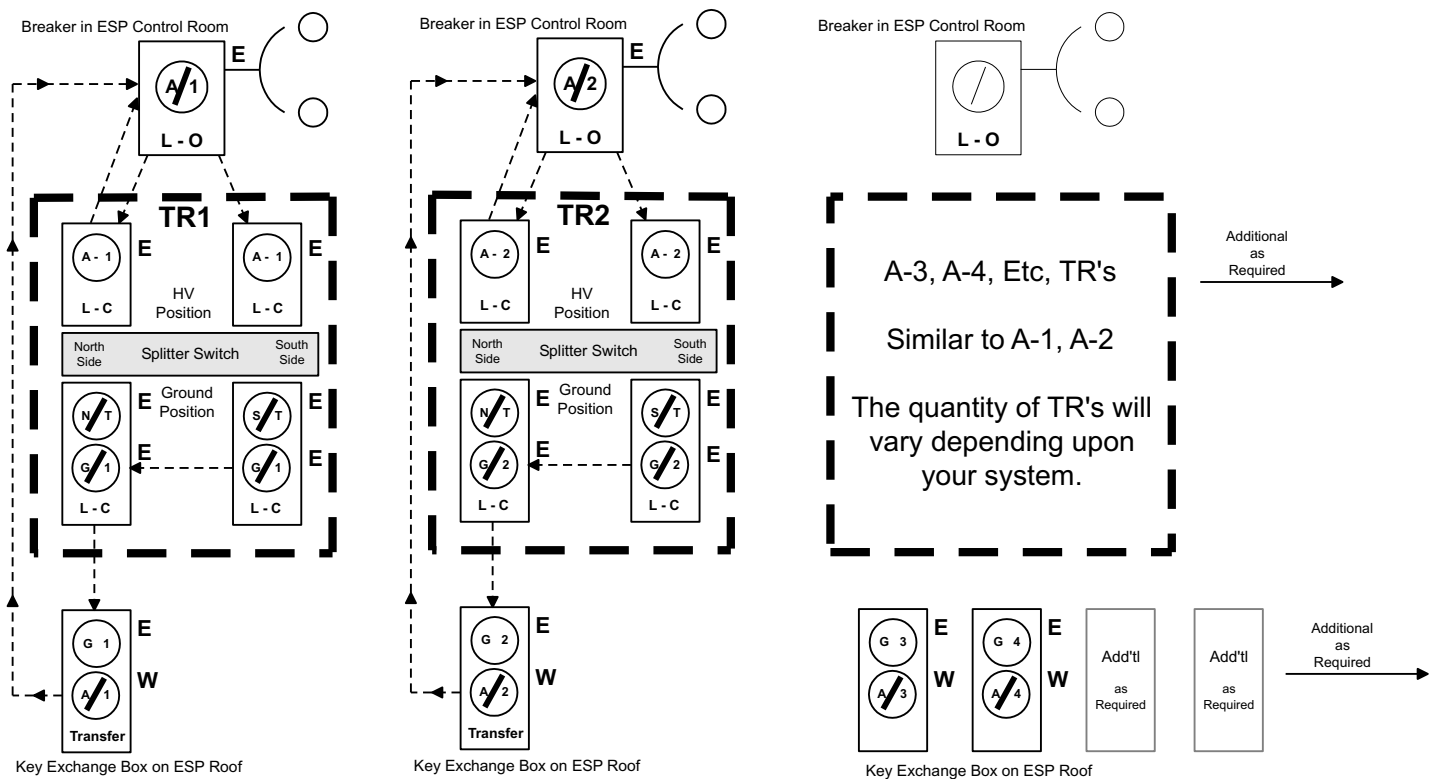
To access the "North" chamber:

1. Open breaker A-1.
2. Turn key A-1 in L-O interlock to lock breaker in the open position. Key A-1 is now free.
3. Lock open all other breakers and free all A keys (A-2, A-3, A-4, etc.).
4. Insert all A keys in their respective L-C interlocks on the "North" side of each TR splitter switch. All A keys are now held.
5. Rotate each TR "North" side splitter switch handle to the ground position.
6. Turn the NT key in each L-C interlock locking each switch handle in the ground position. All NT and "North" side G keys are now free.
7. Insert all "North" side G keys (G1, G2, etc.) into the transfer panel and turn to release all A keys. The G keys are now held.
8. Insert all A keys in their respective L-O interlocks on each main breaker and turn to unlock. The A keys are now held.
9. Close all main breakers to energize the TR "South" fields.
10. Insert all NT keys in the transfer panel to release all DN keys. Turn and remove the DN keys from the transfer panel. Note: DN keys are secondary keys and cannot be removed until all primary keys (NT keys) are inserted and turned.
11. Insert the DN keys in each access door interlock to be opened and turn to unlock. The DN keys will remain held in each access door interlock as long as the door is open.

To restore service to the "North" chamber, close and lock all access doors, return all DN keys to the transfer panel and reverse the above sequence. The "South" chamber can be accessed in the same manner.

Continued Next Page

Scheme 42B



To Remove One Field from Service

To remove the TR1 "North" field from service, proceed as follows:

1. Open breaker A-1.
2. Turn key A-1 in L-O interlock to lock breaker in open position. Key A-1 is now free.
3. Insert key A-1 in the L-C interlock on the "North" side TR1 splitter switch. Turn the key to unlock splitter switch handle. Key A-1 is now held.
4. Rotate the TR1 "North" side splitter switch handle to the ground position.
5. Turn the NT key in the L-C interlock locking the switch handle in the ground position. The NT and G1 keys are now free.
6. Insert and turn the G1 key into the transfer panel to release the A-1 key. The G1 key is now held.
7. Insert the A-1 key in the L-O interlock on the main breaker and turn to unlock. Key A-1 is now held.
8. Close breaker A-1 to energize the TR1 "South" field.

To remove the TR1 "South" field from service and reenergize the TR1 "North" field, proceed as follows:

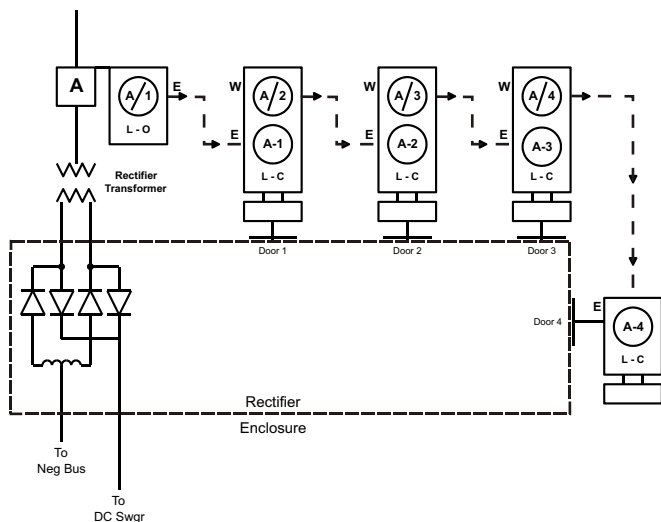
1. Open breaker A-1.
2. Turn key A-1 in the L-O interlock to lock breaker in the open position. Key A-1 is now free.
3. Insert key A-1 in the L-C interlock on the TR1 "South" side splitter switch. Turn the key to unlock the splitter switch handle. Key A-1 is now held.
4. Rotate the TR1 "South" side splitter switch handle to the ground position.
5. Turn the ST key in the L-C interlock locking the switch handle in the ground position. The ST and G1 keys are now free.
6. Insert the G1 key in the L-C interlock on the ground position of the TR1 "North" side splitter switch and turn the NT key to unlock. The NT and G1 keys are now held.
7. Rotate the TR1 "North" side splitter switch handle to the ON position.
8. Turn the A-1 key in the L-C interlock on the TR1 "North" side splitter switch to lock the handle in the ON position. The A-1 key is now free.
9. Insert the A-1 key in the L-O interlock on the main breaker and turn to unlock. Key A-1 is now held.
10. Close breaker A-1 to energize the TR1 "North" field.

Other TR fields can be removed from service in the same manner. Reverse sequence to reenergize each field.

The scheme above represents basic guidelines regarding the proper interlock sequence for an Electro-Static Precipitator. The equipment that comprises an E.S.P., or Baghouse can vary depending upon the manufacturer and age of the equipment. Let us know your specific needs and we will be glad to provide a free proposal without obligation.

Scheme 43

To prevent opening any rectifier enclosure door while the rectifier is operating.



Simple rectifier scheme with "daisy chained" door lock arrangement. Any quantity of rectifier access doors can be accommodated.

Breaker A is normally closed. Key A-1 is held in the L-O interlock on breaker A. Keys A-2, A-3, and A-4 are held in L-C interlock (Type M2D) on rectifier enclosure access doors #1, #2 and #3 respectively. All rectifier enclosure access doors are locked closed.

To gain access to the rectifier enclosure, proceed as follows:

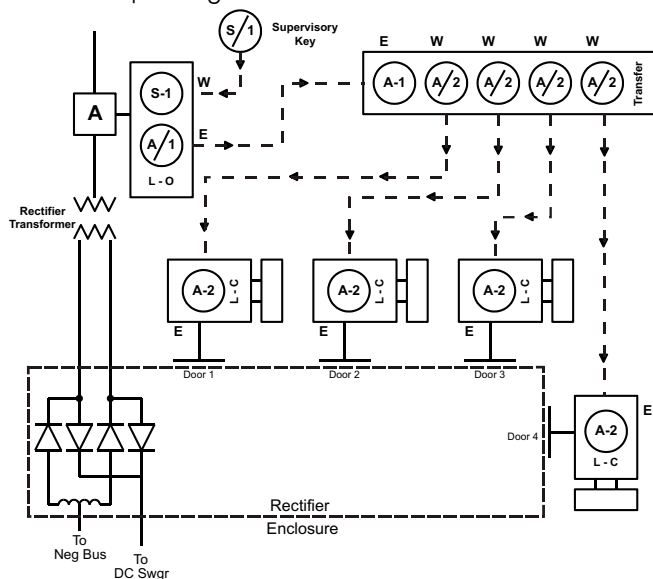
1. Open Breaker A.
2. Turn key A-1 to lock the breaker in the open position. Key A-1 is now free.
3. Insert key A-1 in L-C interlock (Type M2D) on access door #1 and turn to unlock.
4. Open access door #1 to enter the rectifier enclosure. Key A-1 is now held and key A-2 is free.
5. Insert key A-2 in L-C interlock (Type M2D) on access door #2 and turn to unlock.
6. Open access door #2. Key A-2 is now held and key A-3 is free.
7. Insert key A-3 in L-C interlock (Type M2D) on access door #3 and turn to unlock.
8. Open access door #3. Key A-3 is now held and key A-4 is free.
9. Insert key A-4 in L-C interlock (Type D) on access door #4 and turn to unlock.
10. Open access door #4. Key A-4 is now held.

Reverse sequence to restore service.

Note: As an additional precaution, the Type D and M2D door interlocks can be supplied with auxiliary contacts wired to the breaker trip circuit.

Scheme 43A

To prevent opening any rectifier enclosure door while the rectifier is operating.



Simple rectifier scheme allowing doors to be opened in any order. Supervisory key required for initial operation of breaker interlock. Any quantity of rectifier access doors can be accommodated.

Breaker A is normally closed. Key A-1 is held in the L-O interlock on breaker A and supervisory key S-1 is retained by a supervisor. All A-2 keys are held in the transfer interlock. All rectifier enclosure access doors are locked closed.

To gain access to the rectifier enclosure, proceed as follows:

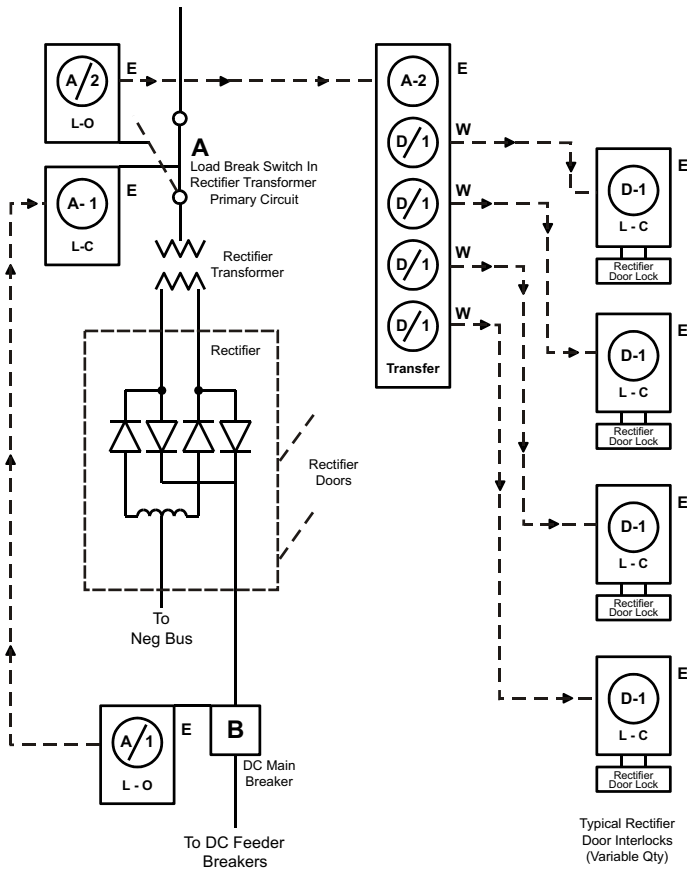
1. Open Breaker A.
2. Insert supervisory key S-1 into L-O interlock on Breaker A and turn key A-1 to lock the breaker in the open position. Key S-1 is now held and key A-1 is free.
3. Insert key A-1 in transfer interlock and turn. Key A-1 is now held and A-2 keys are free.
4. Insert A-2 keys in the L-C interlocks (Type D) on rectifier access doors.
5. Open the rectifier access doors to enter the rectifier enclosure. The A-2 keys are held in each door interlock as long as the door is open.

Reverse sequence to restore service.

Note: As an additional precaution, the Type D door interlocks can be supplied with auxiliary contacts wired to the breaker trip circuit.

Scheme 44

To prevent opening any rectifier enclosure door while the rectifier is operating.



Rectifier with DC output breaker. Any quantity of rectifier access doors can be accommodated.

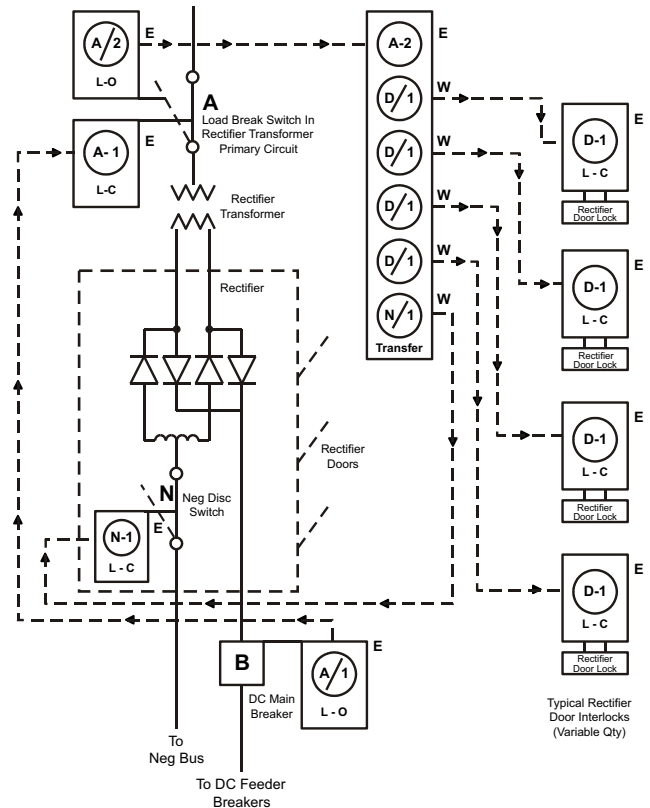
Load break switch A and DC main breaker B are normally closed. Key A-1 is held in the L-O interlock on breaker B. Key A-2 is held in the L-O interlock on load break switch A. All D-1 keys are held in the transfer interlock. All rectifier enclosure access doors are locked closed.

1. Open breaker B.
2. Turn key A-1 to lock the breaker in the open position. Key A-1 is now free.
3. Insert key A-1 in L-C interlock on load break switch A and turn to unlock.
4. Open load break switch A. Key A-1 is now held.
5. Turn key A-2 in L-O interlock on load break switch A and turn to lock the load break switch in the open position. Key A-2 is now free.
6. Insert key A-2 in the transfer interlock and turn. Key A-2 is now held and D-1 keys are free.
7. Insert D-1 keys in the L-C interlocks (Type D) on rectifier access doors.
8. Open the rectifier access doors to enter the rectifier enclosure. The D-1 keys are held in each door interlock as long as the door is open.

Reverse sequence to restore service.

Scheme 45

To prevent opening any rectifier enclosure door while the rectifier is operating and to prevent opening the negative disconnect switch under load.



Rectifier with incoming load break switch, DC output breaker and negative disconnect switch. Any quantity of rectifier access doors can be accommodated.

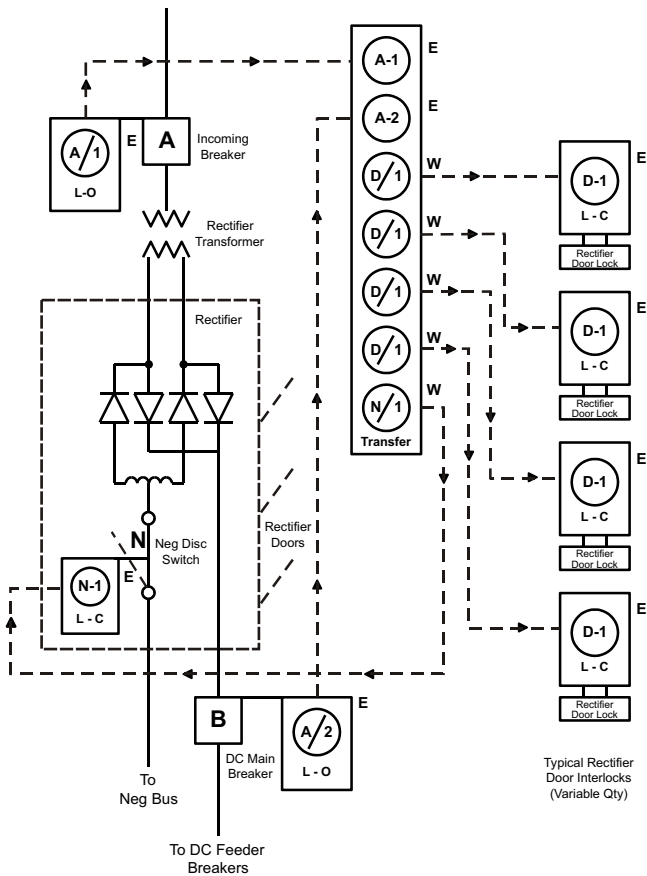
Load break switch A, DC main breaker B and negative disconnect switch N are normally closed. Key A-1 is held in the L-O interlock on breaker B. Key A-2 is held in the L-O interlock on load break switch A. Key N-1 and all D-1 keys are held in the transfer interlock. All rectifier enclosure access doors are locked closed.

1. Open breaker B.
2. Turn key A-1 to lock the breaker in the open position. Key A-1 is now free.
3. Insert key A-1 in L-C interlock on load break switch A and turn to unlock.
4. Open load break switch A. Key A-1 is now held.
5. Turn key A-2 in L-O interlock on load break switch A to lock the load break switch in the open position. Key A-2 is now free.
6. Insert key A-2 in the transfer interlock and turn. Key A-2 is now held. All D-1 keys and key N-1 are now free.
7. Insert D-1 keys in the L-C interlocks (Type D) on rectifier access doors.
8. Open the rectifier access doors to enter the rectifier enclosure. The D-1 keys are held in each door interlock as long as the door is open.
9. Insert key N-1 in L-C interlock on the negative disconnect switch N and turn to unlock.
10. Open negative disconnect switch N. Key N-1 is now held.

Reverse sequence to restore service.

Scheme 45A

To prevent opening any rectifier enclosure door while the rectifier is operating and to prevent opening the negative disconnect switch under load.



Rectifier with incoming breaker, DC output breaker and negative disconnect switch. Any quantity of rectifier access doors can be accommodated.

Incoming breaker A, DC main breaker B and negative disconnect switch N are normally closed. Key A-1 is held in the L-O interlock on breaker A. Key A-2 is held in the L-O interlock on breaker B. Key N-1 and all D-1 keys are held in the transfer interlock. All rectifier enclosure access doors are locked closed.

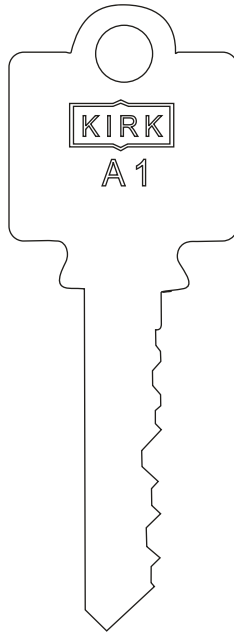
1. Open breaker A.
2. Turn key A-1 in L-O interlock on breaker A to lock the breaker in the open position. Key A-1 is now free.
3. Open breaker B.
4. Turn key A-2 in L-O interlock on breaker B to lock the breaker in the open position. Key A-2 is now free.
5. Insert keys A-1 and A-2 in the transfer interlock and turn. Keys A-1 and A-2 are now held. All D-1 keys and key N-1 are now free.
6. Insert D-1 keys in the L-C interlocks (Type D) on rectifier access doors.
7. Open the rectifier access doors to enter the rectifier enclosure. The D-1 keys are held in each door interlock as long as the door is open.
8. Insert key N-1 in L-C interlock on the negative disconnect switch N and turn to unlock.
9. Open negative disconnect switch N. Key N-1 is now held.

Reverse sequence to restore service.

Notes:

When appropriately applied, Kirk Key Interlock systems ensure that a pre-determined sequence of operation is followed. Kirk Key Interlock systems can prevent expensive machinery and electrical equipment from being damaged due to operator error. On high-voltage switchgear, the proper use of Kirk Key interlocks could ultimately save someone's life.

Most manufacturers provide key interlock provisions on their equipment. With Kirk Key's wide range of components, it is possible to quickly design and supply an interlock system that is custom designed for your specific physical requirements. If you need one key, one lock, or a whole interlock system - Kirk Key is ready to help.



Interlocking is accepted by safety, insurance, and standards authorities throughout the world as the most reliable and cost effective way of guarding against operator error. If you are concerned about preserving safety in your sequential operations, let Kirk Key Interlock Company fulfill your needs with a customized interlocking system for your particular project or operation.



Kirk Key Interlock Company

"The key that ends costly mistakes"

For more information concerning any schemes in this book, or for help in configuring a custom interlock system, please feel free to contact any one of our Product Coordinators. Kirk Key's wide range of components makes it possible to quickly design and supply an interlock system that is custom designed to your specific physical requirements.

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